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# THE AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA  
FOR PROMOTING USEFUL KNOWLEDGE

YEAR BOOK 1941

JANUARY 1, 1941 – DECEMBER 31, 1941



THE AMERICAN PHILOSOPHICAL SOCIETY  
INDEPENDENCE SQUARE  
PHILADELPHIA  
1942



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I  
CHARTER \*

STATUTES AT LARGE OF PENNSYLVANIA  
CHAPTER DCCCXCIV.

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AN ACT

for incorporating the American Philosophical Society held  
at Philadelphia for promoting useful knowledge.



**Whereas** the cultivation of useful knowledge, and the advancement of the liberal arts and sciences in any Country, have the most direct tendency towards the improvement of agriculture, the enlargement of trade, the ease and comfort of life, the ornament of society, and the encrease and happiness of mankind; **And whereas** this country of North America, which the goodness of Providence hath given us to inherit, from the vastness of its extent, the variety of its climate, the fertility of its soil, the yet unexplored treasures of its bowels, the multitude of its rivers, lakes, bays, inlets, and other conveniences of navigation, offers to these United States one of the richest subjects of cultivation, ever presented to any people upon earth; **And whereas** the experience of ages shows that improvements of a public nature, are best carried on by societies of liberal and ingenious men, uniting their labours, without regard to nation, sect or party, in one grand pursuit, alike interesting to all, whereby mutual prejudices are worn off, a humane and philosophical spirit is cherished, and youth are stimulated to a laudable diligence and emulation in the pursuit of wisdom; **And whereas**, upon these principles,

\* Original Charter, Granted in 1780. Articles of Amendment added 1935.

divers public-spirited gentlemen of Pennsylvania and other American States did heretofore unite themselves, under certain regulations, into one voluntary Society, by the name of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by their successful labours and investigations, to the great credit of America, have extended their reputation so far, that men of the first eminence in the republic of letters in the most civilized nations of Europe have done honour to their publications, and desired to be enrolled among their members; **And whereas** the said Society, after having been long interrupted in their laudable pursuits by the calamities of war, and the distresses of our Country, have found means to revive their design, in hopes of being able to prosecute the same with their former success, and being further encouraged therein by the public, for which purpose they have prayed us, "the Representatives of the Freemen of the Commonwealth of Pennsylvania," that they may be created One Body Politic and Corporate forever, with such powers, privileges, and immunities, as may be necessary for answering the valuable purposes which the said Society had originally in view.

**Wherefore**, in order to encourage the said Society in the prosecution and advancement of all useful branches of knowledge, for the benefit of their country and mankind.

[SECTION I.] **Be it enacted**, and it is hereby enacted by the Representatives of the Freemen of the Commonwealth of Pennsylvania, in General Assembly met, and by the authority of the same, That the Members of the said American Philosophical Society heretofore voluntarily associated for promoting useful knowledge, and such other persons as have been duly elected Members and Officers of the same, agreeably to the fundamental laws and regulations of the said Society, comprized in twelve sections, prefixed to their first volume of transactions, published in Philadelphia by William and Thomas Bradford in the year of our Lord one thousand seven hundred and seventy-one, and who shall in

all respects conform themselves to the said laws and regulations, and such other laws, regulations and ordinances, as shall hereafter be duly made and enacted by the said Society, according to the tenor hereof, be and forever hereafter shall be, One Body Corporate and Politic in Deed, by the name and style of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by the same name they are hereby constituted and confirmed One Body Corporate and Politic, to have perpetual succession, and by the same name they and their successors are hereby declared and made able and capable in law, to have, hold, receive, and enjoy lands, tenements, rents, franchises, hereditaments, gifts, and bequests of what nature so ever, in fee simple or for term of life, lives, years or otherwise, and also to give, grant, let, sell, alien, or assign the same lands, tenements, hereditaments, goods, chattels, and premises, according to the nature of the respective gifts, grants, and bequests, made to them the said Society, and of their estate therein. **Provided**, that the amount of the clear yearly value of such real estate do not exceed the value of ten thousand bushels of good merchantable wheat.

[SECTION II.] **And be it further enacted by the authority aforesaid**, That the said Society be, and shall be for ever hereafter able and capable in law to sue, and be sued, plead and be impleaded, answer and be answered unto, defend and be defended in all or any of the courts or other places, and before any Judges, Justices, and other person or persons, in all manner of actions, suits, complaints, pleas, causes, and matters, of what nature or kind so ever, within this Commonwealth; and that it shall and may be lawfull to and for the said Society, for ever hereafter to have and use one common seal in their affairs, and the same at their will and pleasure to break, change, alter and renew.

[SECTION III.] **And be it further enacted by the authority aforesaid**, That for the well governing of the said Society, and ordering their affairs, they shall have the following officers, that is to say, one Patron, who shall be his



Excellency the President of the Supreme Executive Council \* of this Commonwealth, for the time being, and likewise one President, three Vice Presidents, four Secretaries, three Curators, one Treasurer, together with a Council of twelve members; and that on the first Friday of January next, between the hours of two and five in the afternoon, as many of the members of the said Society as shall have paid up their arrears due to the Society, and shall declare their willingness to conform to the laws, regulations and ordinances of the Society then duly in force, according to the tenor hereof, by subscribing the same, and who shall attend in the Hall or place of meeting of the said Society, within the time aforesaid, shall chuse by ballot, agreeable to the fundamental laws and regulations herein before referred to, one President, three Vice Presidents, four Secretaries, three Curators, and one Treasurer, and at the same time and place, the members met and qualified as aforesaid shall in like manner chuse four members for the Council, to hold their offices for one year, four more members for the Council to hold their offices for two years, and four more members for the Council, to hold their offices for three years. And on the first Friday in January, which shall be in the year of our Lord one thousand seven hundred and eighty-two, and so likewise on the first Friday of January, yearly and every year thereafter, between the hours of two and five in the afternoon, the Members of the said Society met and qualified as aforesaid, shall chuse one President, three Vice Presidents, four Secretaries, three Curators and one Treasurer, to hold their respective offices for one year, and four Council Men to hold their offices for three years, *Provided* that no person residing within the United States shall be capable of being President, Vice President, Secretary, Curator, Treasurer, or member of the Council, or of electing to any of the said offices, who is not capable of electing and being elected to civil offices within the State in which he resides. *Provided also*, that nothing herein

\* [Now His Excellency the Governor of this Commonwealth.]

contained shall be considered as intended to exclude any of the said Officers or Councillors, whose times shall be expired, from being re-elected, according to the pleasure of the said Society; and of the day, hours and place of all such elections, due notice shall be given by the Secretaries, or some one of them, in one or more of the public newspapers of this State, agreeable to the said fundamental laws and regulations before referred to.

[SECTION IV.] **And be it further enacted by the authority aforesaid,** That the Officers and Council of the said Society shall be capable of exercising such power for the well governing and ordering the affairs of the Society, and of holding such occasional meetings for that purpose, as shall be described, fixed, and determined by the statutes, laws, regulations and ordinances of the said Society, hereafter to be made. *Provided always,* that no statute, law, regulation or ordinance shall ever be made or passed by the said Society, or be binding upon the members thereof, or any of them, unless the same hath been duly proposed, and fairly drawn up in writing, at one stated meeting of the Society, and enacted or passed at a subsequent meeting at least the space of fourteen days after the former meeting, and upon due notice in some of the public newspapers, that the enacting of statutes and laws, or the making and passing ordinances and regulations, will be part of the business of such meeting; nor shall any statute, law, regulation or ordinance be then or at any time enacted or passed, unless thirteen members of the said Society, or such greater number of members as may be afterwards fixed by the rules of the Society, be present, besides such quorum of the Officers and Council, as the laws of the Society for the time being may require, and unless the same be voted by two-thirds of the whole body then present; all which statutes, laws, ordinances and regulations, so as aforesaid duly made, enacted and passed, shall be binding upon every member of the said Society, and be from time to time inviolably observed, according to the tenor and effect thereof; pro-

vided they be not repugnant or contrary to the laws of this Commonwealth, for the time being in force and effect.

**And whereas** nations truly civilized (however unhappily at variance on other accounts) will never wage war with the Arts and Sciences, and the common Interests of humanity:

[SECTION V.] **Be it further enacted by the authority aforesaid,** That it shall and may be lawful for the said Society by their proper officers, at all times, whether in peace or war, to correspond with learned Societies, as well as individual learned men, of any nation or country, upon matters merely belonging to the business of the said Society, such as the mutual communication of their discoveries and proceedings in Philosophy and Science; the procuring books, apparatus, natural curiosities, and such other articles and intelligence as are usually exchanged between learned bodies, for furthering their common pursuits; **Provided always,** That such correspondence of the said Society be at all times open to the inspection of the Supreme Executive Council of this Commonwealth.

[Signed]

JOHN BAYARD,  
*Speaker.*

**Enacted into a Law at Philadelphia on Wednesday the fifteenth day of March anno Domini one thousand seven hundred and eighty.**

[Signed]

THOMAS PAINE,  
*Clerk of the General Assembly.*

COMMISSION FOR THE COMPILATION OF THE LAWS  
OF PENNSYLVANIA PRIOR TO 1800.

CLERK'S OFFICE,  
1211 BETZ BUILDING.

JAMES T. MITCHELL, } *Commissioners.* CHAS. R. HILDEBURN, *Clerk.*  
HENRY FLANDERS, }

PHILADELPHIA, March 12, 1898.

Compared, revised and found to be a correct copy of the original enrollment in the archives of the Commonwealth, by me the custodian of the said original as clerk of the commissioners appointed under the act of May 19, 1887, entitled, AN ACT FOR THE COMPILATION AND PUBLICATION OF THE LAWS OF THE PROVINCE AND COMMONWEALTH OF PENNSYLVANIA PRIOR TO THE YEAR ONE THOUSAND EIGHT HUNDRED, P.L. 1887, pp. 129 and 130.

CHAS. R. HILDEBURN,  
*Clerk of the Commissioners.*

Witness as to Chas. R. Hildeburn :

WM. NEWBOLD ELY,  
JULIUS F. SACHSE.



Sworn to and subscribed before me  
this 19th day of May, 1898.

JAMES P. STERRETT,  
*Chief Justice of the Supreme Court  
of Pennsylvania.*

## ARTICLES OF AMENDMENT

## ARTICLE I

Notwithstanding the Proviso at the end of the first paragraph following the preamble of this Charter, or any other proviso thereof, the Society shall have the capacity and authority without limitation by this Charter to purchase, take, receive, lease as lessee, take by gift, devise or bequest, or otherwise acquire, and to own, hold, use, and otherwise deal with any and all real or personal property, or any interest therein, wherever situated.

## ARTICLE II

Any provisions of this Charter which are purely administrative in their nature, including those concerning the officers, the members of the council, and the date and time of meetings, may be altered by a law, regulation or ordinance of the Society duly adopted and not repugnant or contrary to the laws of this Commonwealth.

## CERTIFICATE OF ACCEPTANCE

1. The name of the accepting corporation is The American Philosophical Society held at Philadelphia for promoting useful knowledge.

2. The American Philosophical Society was created by the Act of Assembly approved March 15, 1780, L.B. No. 1, 363.

3. The American Philosophical Society herewith accepts the Constitution of Pennsylvania and the provisions of the Nonprofit Corporation Law.

4. The acceptance made herewith was duly authorized by a meeting of the members called for that purpose, held in Philadelphia on the 6th day of December, 1935.

ROLAND S. MORRIS  
*President*

C. F. SKINKER  
*Assistant Secretary*



Filed this 12th day of  
December, 1935

J. WARREN MICKLE

Deputy Secretary of the Commonwealth

Recorded in

Miscellaneous Corporation

Record Book 210, P. 125

## II

### LAWS

(As Amended April 24, 1936, April 22, November 19, 1938,  
and November 18, 1939)

#### CHAPTER I

*Of the Members both resident and foreign: their classification, nomination, and election; suspension and forfeiture of membership.*

ART. 1. The resident members of the Society are elected from among citizens or residents of the United States who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of the learned professions, or in the administration of affairs. Their number may not exceed five hundred, nor may more than thirty be elected in any one year.

ART. 2. The foreign members of the Society are elected from among persons who are neither citizens nor residents of the United States, and who are of the greatest eminence for their attainments in science, letters, or the liberal arts. Their number may not exceed sixty, nor may more than eight be elected in any one year.

ART. 3. Every member, whether resident or foreign, shall be classified according to his expressed wishes, or in accordance with his principal activities or contributions to knowledge, in one of the following four classes: \*

\* In accordance with general usage, the following more or less clearly defined fields of science and learning within the four classes have been recognized by the Society in recent years: Class I. Mathematics; Astronomy; Physics; Chemistry; Engineering. Class II. Geology, Paleontology, Geography; Zoology, Anatomy; Botany, Bacteriology; Anthropology, Psychology; Physiology, Pathology; Medicine, Pharmacology, Surgery. Class III. Political Science, Economics, Statistics and Sociology; Modern History; Jurisprudence; Administration, Government; Affairs. Class IV. Philosophy, Education; Ancient, Medieval and Cultural History; Archaeology, History of Art, Architecture; Literary History; Languages; Letters, Fine Arts.

Class I. Mathematical and Physical Sciences

Class II. Geological and Biological Sciences

Class III. Social Sciences

Class IV. Humanities

ART. 4. In each of the four classes of members there shall be a Committee on Membership consisting of a Chairman and four other members, appointed by the President.

ART. 5. Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society. These nominations shall be known respectively as "Committee nominees," and "Member nominees," and shall be so listed in the *preliminary ballot*. These nominations must be in the Executive Office before December first. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed in the Executive Office before November first following and shall be listed as "Continued nominations" in the *preliminary ballot*; these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations.

ART. 6. Immediately after December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Executive Office before January first.

ART. 7. Before February first each Committee on Membership shall select from among those nominees having a

high number of votes in the *preliminary ballot* not more than twelve for resident membership and not more than five for foreign membership in each class, due regard being given to a proper representation of the various subjects within the class.

ART. 8. Before February first, the Council may nominate not more than three persons in each year whose names shall be presented to the Society in the *preference ballot* as "Council nominees" together with their qualifications. These nominations shall be on the regular blank forms provided for that purpose.

ART. 9. It shall be the duty of each Committee on Membership to prepare, with such outside assistance as it may choose, a brief biographical sketch of each of the nominees so selected, listing his profession, position, qualifications, and important publications or contributions to science, literature, art or affairs. The names of these nominees, together with the biographical sketch of each, shall then be printed in alphabetical order under each class, and shall be sent confidentially to all members of the Society not later than March first. Members shall be invited to return to the Executive Office before April first a *preference ballot* on which they have checked the names of not more than thirty nominees for resident membership and of not more than eight for foreign membership.

ART. 10. The Council at the meeting next preceding the General Meeting of the Society in the month of April, notice of which shall be given at least two weeks in advance, shall select by ballot from the list of nominees residing within the United States a number not exceeding thirty, and of non-residents of the United States a number not exceeding eight, to be recommended to the Society for election. In this selection special weight shall be given to the votes of members in the preference ballot. The names of the nominees so chosen, arranged alphabetically in classes, shall be reported to the Society at its next ensuing session.



ART. 11. Election to membership, both resident and foreign, shall be by ballot at the General Meeting of the Society in the month of April. A two-thirds vote of those present and voting shall be necessary to elect.

ART. 12. The members are mutually pledged not to mention to non-members of the Society the name of any nominee proposed, or of any withdrawn or unsuccessful nominee.

ART. 13. Every person who is elected a resident or foreign member shall signify his acceptance in writing within one year after the mailing of notification of such election. In default of such acceptance the election shall be void.

ART. 14. The formal admission of a member into the Society shall be at his first attendance at a meeting of the Society after his election and in the manner and form following: He shall subscribe the Laws in the Roll Book and be introduced to the President, who, taking him by the hand, shall say:

*"By the authority and in the name of the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge, I do admit you a Member thereof."*

ART. 15. The Society may from time to time assess membership dues in accordance with its needs and policies. Any person who shall refuse or neglect to pay such assessment for two years, after two or more notifications from the Treasurer, shall be reported to the Society as delinquent and his name shall be stricken from the roll of members.

ART. 16. The membership of any resident or foreign member may, for good and sufficient cause, and upon recommendation by the Council, be terminated by the Society at a General Meeting by a vote of two-thirds of the members attending, provided, however, that the total number of members so attending shall be not less than thirty.

## CHAPTER II

*Of the Patron and Elective Officers; qualifications, nominations and elections, terms of office, suspension or removal, vacancies.*

ART. 1. The Governor of Pennsylvania shall be ex-officio the Patron of the Society.

ART. 2. The elective Officers of the Society shall be a President, three Vice-presidents, two Secretaries, a Curator, a Treasurer, and twelve Councillors.

ART. 3. No person save the Treasurer, who may be a Corporation, shall be capable of holding any elective office as defined above, who is not a citizen of the United States.

ART. 4. Nominations to the elective offices of the Society are made by the Committee on Nominations as hereinafter provided, and may also be made by petition signed by not less than twenty members, in such manner as may be prescribed by the Committee on Nominations and approved by the Council.

ART. 5. The election of Officers shall be held at the General Meeting in the month of April at a time duly announced in the program. The election shall be by ballot, a majority of all ballots cast being requisite for election. In the event that no candidate for a given office shall receive such a majority, a second ballot shall be taken and election shall be by plurality of votes cast.

ART. 6. The terms of all elective Officers, except Councillors, are of one year, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors and are eligible for reelection.

ART. 7. The terms of Councillors are of three years, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors, but are ineligible for reelection until one year after the expiration of their terms of office.

ART. 8. Any elective Officer may be suspended or removed from office, for good and sufficient cause, at a meeting of the Council, by a vote of two-thirds of all its members.

ART. 9. A vacancy occurring in any elective office may be filled for the unexpired term by vote of a majority of the Council.

### CHAPTER III

#### *Of the Officers and their duties*

ART. 1. The PRESIDENT shall preside at the meetings of the Society and Council; he shall appoint all committees, and designate their chairmen, except as otherwise provided in the Laws, and shall be ex-officio a member of all committees except the Committee on Nominations.

ART. 2. The VICE-PRESIDENTS shall preside at meetings of the Society and Council, in the absence of the President, in rotation in order of seniority of continuous service. In the event of the death or disability of the President, the senior Vice-president shall act as President until the vacancy shall be filled.

ART. 3. The SECRETARIES shall have the custody of the Seal of the Society, shall record the proceedings of the Society and the Council, shall notify all acts of the Society and the Council to those concerned, shall conduct the correspondence of the Society and Council, shall maintain the authentic list of resident and foreign members, and shall have the custody of the Society's files and records. The Secretaries shall arrange among themselves each year as to the distribution and performance of their duties, and shall report such arrangement to the Council; they shall also have power to delegate the performance of their duties to the Assistant Secretary or Executive Officer.

ART. 4. The CURATOR shall have charge of the Cabinet, and shall supervise the maintenance, exhibit, and use of the Society's collections, and shall advise the Council with

respect to their increase, disposal, or temporary loan. He shall be ex-officio a member of the Committee on the Hall.

ART. 5. The TREASURER may be a person, as defined in Chap. II, Art. 3, or a trust company or other suitable financial corporation of the State of Pennsylvania. He shall collect and receive all moneys due or payable to the Society or entrusted to its care, and all gifts and bequests made to it. He shall pay all bills due by the Society when properly approved, in accordance with appropriations authorized by the Society or the Council, or in accordance with the terms of trust funds established for specific purposes. He shall deposit the funds and securities of the Society in its name with such banks or trust companies in the State of Pennsylvania as may be approved by the Committee on Finance.

ART. 6. The Treasurer shall keep accounts in good and regular order of all receipts and expenditures and of all moneys or other property in his hands, and shall report them, and present them for audit, as may be required by the Committee on Finance.

ART. 7. The Treasurer may, if authorized by vote of the Committee on Finance, employ an assistant treasurer or a trust company or other suitable financial corporation of the State of Pennsylvania, approved by the Committee on Finance, for the performance of such duties as may be delegated to such agent.

ART. 8. The Treasurer shall give bond, at the expense of the Society, for the faithful execution of all his trusts, in such amount as may be required by the Committee on Finance.

ART. 9. The Treasurer shall, upon the expiration of his term of office, deliver over to the Committee on Finance, for transmittal to his successor, the books, papers, moneys, and property remaining in his hands.

## CHAPTER IV

*Of the Council and the Annual Budget*

ART. 1. The COUNCIL shall consist of the Officers, the twelve Councillors, and the Chairmen of the Committees on Finance, Research, Publications, Library and Hall.

ART. 2. The Council shall hold at least two meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept.

ART. 3. The Council shall make recommendations for membership in the Society as provided in Chap. I, Art. 9, of the Laws, and elect members of the Committees on Research and Publications as provided in Chap. 5, Arts. 5 and 8.

ART. 4. The Council shall, at such time as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April or November.

ART. 5. The Council shall have power to take action for the Society in legal matters, to manage its affairs, and to assume its administration, to make contracts or to authorize them to be made in the name of the Society, except as otherwise provided.

ART. 6. The Council shall require reports to be presented to it at least once a year by such officers, committees, and employees of the Society as they may designate, or as may be required by the Laws to present such reports, and shall, through the President, present an annual report to the Society on the state of its affairs.

ART. 7. The Council shall have power to appoint an administrative Executive Officer, and to fix his term of service, duties and compensation.

## CHAPTER V

*Of the Committees of the Society*

ART. 1. There shall be four COMMITTEES ON MEMBERSHIP, one in each class, each composed of five members whose appointment and duties are prescribed in Chap. I, Arts. 4-8.

ART. 2. There shall be a COMMITTEE ON FINANCE, consisting of the President and Treasurer, ex-officio, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April. A majority of the Committee shall constitute a quorum at any meeting. The Committee shall keep a record of all its acts and proceedings, which shall be communicated to the Council.

ART. 3. The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

ART. 4. The Committee on Finance shall always have

access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget.

ART. 5. There shall be a COMMITTEE ON RESEARCH, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Publications, and of the Committee on Meetings, may sit with the Committee on Research but shall not vote.

ART. 6. The Committee on Research shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for the advancement of knowledge through investigation. It may take such action as it shall see fit with respect to proposals received by it, and may, with the approval of the Council, itself initiate and cause to be executed investigations for the advancement of knowledge. It shall certify to the Treasurer all disbursements to be made from funds appropriated to it by the Council, and may allot therefrom such sums as it may see fit, on such conditions as it may prescribe, for the investigations approved by it. It shall require reports of the expenditures of all sums so allotted, and of the progress of all investigations aided thereby. It may withhold assistance in the event that the said reports are judged unsatisfactory.

ART. 7. The Committee on Research shall report all its acts to the Council, and from time to time submit reports

to the Society on the progress of the investigations aided by it, and on the contributions to the advancement of knowledge made by them.

ART. 8. There shall be a COMMITTEE ON PUBLICATIONS, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Meetings, may sit with the Committee on Publications but shall not vote.

ART. 9. The Committee on Publications shall supervise the contents, editing, printing, publication, distribution, and sale of all publications issued by the Society or in its name. It shall have power to employ necessary editorial assistance, and, with the approval of the Council, to appoint an Editor and to determine his duties and fix his compensation. It shall cause the necessary contracts for the manufacture of the Society's publications to be drawn up and executed. It shall certify to the Treasurer all bills which it shall have examined and approved for expenses attending the publications, as well as all disbursements to be made from funds appropriated to the Committee by the Council.

ART. 10. The Committee on Publications shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for publication, and may take such action as it shall see fit with respect to proposals so received, including the allotment of funds appropriated to the Committee by the Council. The Committee shall have power to appoint referees or special sub-committees to assist it in the examination of material presented to it for publication and, in its discretion, to give honoraria for services so rendered. It shall report all its acts to the Council.



ART. 11. There shall be a COMMITTEE ON MEETINGS, consisting of the President, ex-officio, and of not fewer than four other members representative of the four classes. The Committee shall be appointed by the President and shall have power to add to its numbers. A majority of the Committee shall constitute a quorum at any meeting and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Publications, may sit with the Committee on Meetings but shall not vote.

ART. 12. The Committee on Meetings shall be charged with the preparation of the scientific and scholarly programs of all meetings of the Society, and of all meetings held under its auspices, and with the organization of discussions, symposia, and conferences. It shall have power to name special sub-committees to assist it, and to invite suitable persons, whether members of the Society or not, to participate in such programs, discussions, symposia, etc. The Committee shall have power to use such funds as may be appropriated to it by the Council for defraying the expenses of the programs, discussions, etc., organized by it, and shall certify to the Treasurer all disbursements to be made from such funds.

ART. 13. The Committee on Meetings shall transmit to the Committee on Publications all papers, communications, reports, and other materials which it may recommend for publication.

ART. 14. There shall be a COMMITTEE ON LIBRARY, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be appointed by the President.

ART. 15. The Committee on Library shall supervise the administration of the Library, and shall, with the approval of the Council, prescribe regulations for its government and use. The Committee shall have power, with the ap-

proval of the Council, to employ a Librarian, determine his duties, and fix his compensation. It shall have charge of the exchange of publications, and shall have power to expend income of trust funds established specifically for purposes of the Library. The Committee shall prepare estimates of expenditures for the maintenance and increase of the Library, and shall certify to the Treasurer all bills properly payable and all disbursements to be made from funds appropriated by the Council for the purposes of the Library.

ART. 16. There shall be a COMMITTEE ON HALL, consisting of the President and Curator, ex-officio, and such other members as may be appointed by the President. They shall serve for three years and shall have charge of the Hall of the Society and of its furniture and fixtures and shall direct all necessary repairs.

ART. 17. There shall be a COMMITTEE ON NOMINATION OF OFFICERS consisting of five members,—a Chairman, appointed by the President, and the four Councillors who are entering the third year of their term of service.

ART. 18. The Committee shall, not later than December first, invite all members of the Society to submit to it informal suggestions for nominations to all offices to be filled by election at the next General Meeting.

ART. 19. The Committee shall then communicate to all members of the Society, not later than February first, a report presenting one nomination to each office to be filled by election at the next General Meeting. Nominations may also be made by petition if signed by twenty or more members and submitted to the Chairman not later than March first. Notice of such nomination must be sent to all members by April first.

ART. 20. The Committee shall prepare for use in the elections at the General Meeting a ballot in which shall be included, under each position to be filled by election, the name of the Committee's nominee, and the names, in alphabetical order, of any nominees included in petitions duly received in accordance with the Laws.

## CHAPTER VI

*On the Meetings of the Society*

ART. 1. The Annual General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business not in contravention of the Laws.

ART. 2. The Autumn General Meeting shall be held on days designated by vote of the Council, usually in the month of November, at which it shall be lawful to transact all business not in contravention of the Laws.

ART. 3. Special meetings may be called at any time by order of the President, or, in his absence or disability, by order of a Vice-president, or by vote of the Council, for the consideration of matters of scientific or scholarly interest or for the transaction of such business as shall be specified in the order or vote calling the meeting.

## CHAPTER VII

*Of the Publications of the Society*

ART. 1. The publications of the Society shall consist of PROCEEDINGS, TRANSACTIONS, MEMOIRS, YEAR BOOK, and of such other serial or separate publications as may be authorized by the Council upon recommendation by the Committee on Publications.

ART. 2. The PROCEEDINGS shall contain papers that are read before the Society at its meetings and that have been approved by the Committee on Publications. Other papers from whatever source may also be published in the PROCEEDINGS if approved by this Committee. The PROCEEDINGS will be distributed without charge, as issued, to the members who request it.

ART. 3. The TRANSACTIONS shall consist of contributions in the form of monographs, treatises, collections of documents, and other materials, approved by the Committee on Publications. The TRANSACTIONS shall be issued in complete parts, one or more of which may constitute a volume.

They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

ART. 4. The MEMOIRS shall consist of works approved by the Committee on Publications. They shall be issued in such form as shall make possible their assembly in volumes according to subject matter, or to fields of knowledge. They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

ART. 5. The YEAR BOOK shall contain, among other items, the Charter and Laws, list of Officers and Committees, the annual report of the President and Officers, important acts of the Society and Council, reports of all standing Committees, a catalogue of prizes, premiums and lectureships, lists of all members together with those elected and those deceased during the year, and obituaries of deceased members. It shall be published as soon as possible after the close of each calendar year and shall be sent gratis to all members of the Society.

## CHAPTER VIII

### *Of the Laws of the Society and their Amendment*

ART. 1. No amendment or supplement to these laws, nor any new law shall be made or passed by the Society, unless the same has been duly proposed in writing at a Stated Meeting of the Society and enacted at the subsequent General Meeting; due notice of the proposed law or amendment having been sent by mail at least fourteen days before the said General Meeting to the members qualified to vote thereon.

ART. 2. At the General Meeting no amendment or supplement to these laws shall be made, nor shall any new law be made, unless there be present a quorum of at least twenty members, of whom not fewer than five shall be members of the Council, and the same be voted by two-thirds of the whole body present.



III  
OFFICERS AND COMMITTEES  
1941-1942

OFFICERS

PATRON

THE GOVERNOR OF PENNSYLVANIA

PRESIDENT

ROLAND S. MORRIS

VICE-PRESIDENTS

EDWIN G. CONKLIN    WILLIAM E. LINGELBACH    FRANK AYDELOTTE

SECRETARIES

W. F. G. SWANN

BENJAMIN D. MERITT

CURATOR

ALBERT P. BRUBAKER

TREASURER

FIDELITY-PHILADELPHIA TRUST COMPANY

EXECUTIVE OFFICER

EDWIN G. CONKLIN

COUNCILLORS

Elected in 1939

ALBERT F. BLAKESLEE  
WALDO G. LELAND  
HAROLD G. MOULTON  
W. F. G. SWANN

Elected in 1940

DETLEV W. BRONK  
NATHAN HAYWARD  
FREDERICK P. KEPPEL  
HARLOW SHAPLEY

Elected in 1941

WILLIAM B. DINSMOOR  
ROSS G. HARRISON  
HERBERT E. IVES  
JOSEPH H. WILLITS

## STANDING COMMITTEES

The President is *ex-officio* a member of all committees except the Committee on Nomination of Officers. The first member named in each committee is Chairman. The Executive Officer sits with all committees but does not vote unless regularly a member.

## FINANCE

(For one year, 1941-42)

MARSHALL S. MORGAN  
MORRIS DUANE  
THOMAS S. GATES  
EDWARD HOPKINSON, JR.  
JOHN STORY JENKS  
CHARLES J. RHOADS  
J. HENRY SCATTERGOOD

## HALL

(For three years)

JOHN STORY JENKS (1940-43)  
PAUL P. CRET (1939-42)  
MARSHALL S. MORGAN (1939-42)  
LAWRENCE J. MORRIS (1939-42)  
FRANCIS R. PACKARD (1941-44)  
JOHN M. SCOTT (1939-42)  
ALBERT P. BRUBAKER, Curator

## RESEARCH

(For three years)

EDWIN G. CONKLIN (1939-42)  
WM. F. ALBRIGHT (1939-42)  
DETLEV W. BRONK (1939-42)  
GILBERT CHINARD (1941-44)  
CARLTON J. II. HAYES (1941-44)  
JOHN A. MILLER (1939-42)  
ALFRED N. RICHARDS (1939-42)  
HARLOW SHAPLEY (1939-42)  
EDMUND W. SINNOTT (1940-43)  
W. F. G. SWANN (1939-42)  
HUGH S. TAYLOR (1939-42)

## PUBLICATIONS

(For three years)

JACOB R. SCHIRAMM (1941-44)  
FRANK AYDELOTTE (1939-42)  
EDWIN G. CONKLIN (1939-42)  
FRANKLIN EDGERTON (1939-42)  
BENJAMIN D. MERITT (1939-42)  
JOHN A. MILLER (1939-42)  
ERNEST M. PATTERSON (1941-44)  
CONYERS READ (1939-42)  
HAROLD G. UREY (1941-44)  
JAMES T. YOUNG (1939-42)  
ARTHUR W. GOODSPEED, Editor.

## MEETINGS

(For one year, 1941-42)

EDWIN G. CONKLIN  
EDWARD S. CORWIN  
KARL K. DARROW  
DOUGLAS JOHNSON  
WALDO G. LELAND  
WILLIAM E. LINGELBACH  
JOHN A. MILLER  
HENRY NORRIS RUSSELL  
WENDELL M. STANLEY

## LIBRARY

(For three years)

ST. GEORGE L. SIOUSSAT (1939-42)  
GEORGE A. BARTON (1939-42)  
RUTH CARPENTER (1940-43)  
WALDO G. LELAND (1939-42)  
WM. E. LINGELBACH (1939-42)  
J. PERCY MOORE (1940-43)  
HORACE C. RICHARDS (1939-42)  
A. S. W. ROSENBAUGH (1941-44)

**COMMITTEES ON MEMBERSHIP**

(For one year, 1941-42)

**CLASS I. MATHEMATICAL  
AND PHYSICAL SCIENCES**

LUTHER P. EISENHART  
KARL K. DARROW  
DUGALD C. JACKSON  
HARLOW SHAPLEY  
HUGH S. TAYLOR

**CLASS II. GEOLOGICAL AND  
BIOLOGICAL SCIENCES**

DETLEV W. BRONK  
ARTHUR F. BUDDINGTON  
RALPH E. CLELAND  
ROSS G. HARRISON  
ROBERT M. YERKES

**CLASS III. SOCIAL SCIENCES**

ERNEST M. PATTERSON  
EDWARD P. CHEYNEY  
EDWARD S. CORWIN  
JESSE S. REEVES  
CHARLES J. RHOADS

**CLASS IV. HUMANITIES**

WILLIAM F. ALBRIGHT  
CAMPBELL BONNER  
VAN WYCK BROOKS  
GILBERT CHINARD  
HARRY M. LYDENBERG

**COMMITTEE ON NOMINATION OF OFFICERS**

(For one year, 1941-42)

MARSHALL S. MORGAN, Chairman

|                     |                        |
|---------------------|------------------------|
| ALBERT F. BLAKESLEE | } Retiring Councillors |
| WALDO G. LELAND     |                        |
| HAROLD G. MOULTON   |                        |
| W. F. G. SWANN      |                        |

**SPECIAL COMMITTEES**

The first named in each Committee is Chairman.

**EDUCATION AND PARTICIPA-  
TION IN SCIENCE**

EDWIN G. CONKLIN  
ANTON J. CARLSON  
KARL K. DARROW  
LUTHER P. EISENHART  
C. E. KENNETH MEES  
OSCAR RIDDLE  
HARLOW SHAPLEY  
GEORGE G. SIMPSON  
W. F. G. SWANN  
EDWARD L. THORNDIKE  
HAROLD C. UREY  
ROLAND S. MORRIS, *ex-officio*  
W. STEPHEN THOMAS, Executive  
Secretary

**LEWIS PRIZE**

EDWIN G. CONKLIN  
DETLEV W. BRONK  
GILBERT CHINARD

**HENRY M. PHILLIPS PRIZE**

ROLAND S. MORRIS  
JOSEPH PERKINS CHAMBERLAIN  
HERBERT F. GOODRICH

**MAGELLANIC PRIZE**

ROLAND S. MORRIS  
LYMAN J. BRIGGS  
HARVEY N. DAVIS  
HARLOW SHAPLEY



**BICENTENNIAL CELEBRATION  
OF THE BIRTH OF  
THOMAS JEFFERSON**

ROLAND S. MORRIS  
GILBERT CHINARD  
FREDERIC A. DELANO  
S. A. MITCHELL  
ST. GEORGE L. SIOUSSAT  
CHARLES WARREN  
THOMAS J. WERTENBAKER

**FUTURE POLICY OF THE  
LIBRARY**

MAX FARRAND  
HARRY M. LYDENBERG  
HARLOW SHAPLEY  
ST. GEORGE L. SIOUSSAT

**EDITORIAL BOARD**

EDWIN G. CONKLIN, Editor-in-Chief  
KARL K. DARROW, Editor for Class I  
MERKEL H. JACOBS, Editor for Class II  
ERNEST M. PATTERSON, Editor for Class III  
RHYS CARPENTER, Editor for Class IV  
ARTHUR W. GOODSPEED, Managing Editor

**EXECUTIVE OFFICE STAFF**

EDWIN G. CONKLIN, Executive Officer  
JULIA A. NOONAN, Assistant Secretary  
MARIE A. RICHARDS, Assistant in the Office

**LIBRARY STAFF**

LAURA E. HANSON, Librarian \*  
GERTRUDE D. HESS, Assistant Librarian  
ALBAN W. HOOPES, Archivist  
RUTH A. DUNCAN, Assistant in the Library  
MARY C. DOTHARD, Stenographer  
GEORGE THOMAS GARVER, JR., Microfilm Photographer  
M. BARBARA O'NEILL, Restorer of Manuscripts

\* Retired September 1, 1941.

## IV

### MINUTES OF THE EXECUTIVE SESSIONS

#### 1. MIDWINTER MEETING, FEBRUARY 14, 15, 1941

The Midwinter Meeting was held in commemoration of the life and work of Alexander Dallas Bache and the one hundredth anniversary of the establishment of the magnetic observatory on the grounds of Girard College. A symposium on geomagnetism was presented, the program<sup>1</sup> for which was arranged with the cooperation of the American Philosophical Society, the United States Coast and Geodetic Survey, the Department of Terrestrial Magnetism of the Carnegie Institution of Washington and Girard College.

Approximately one hundred members and guests attended the various sessions.

Frank B. Jewett, a recently elected member, subscribed the Laws on February 14 and was admitted into the Society.

#### 2. ANNUAL GENERAL MEETING, APRIL 24, 25, 26, 1941

One hundred and twenty-eight members and approximately one hundred and fifty guests attended the meeting and twenty-six papers were read.<sup>2</sup>

The following recently elected members subscribed the Laws and were admitted into the Society during the course of the meeting: John Howard Northrop, Frederick Lee Hiesaw, Karl S. Lashley, Sylvanus Griswold Morley, Jerome Clarke Hunsaker.

*Friday, April 25, 9:30 A.M.*

#### EXECUTIVE SESSION

Roland S. Morris, President, in the Chair

The proceedings of the Council at its meeting of April 23 were approved.

<sup>1</sup> See p. 47.

<sup>2</sup> See p. 49.

President Morris read the names of those members<sup>1</sup> who had died since the last meeting while the members present stood as a mark of respect.

President Morris gave a brief account of the financial situation of the Society and expressed the Society's obligation to the Committee on Finance for the splendid work they have done.

President Morris reported that the Society had received, through the residuary estate of Walter Wood, a piece of sixteenth century Italian lace which had belonged to Juliana Wood. This had been loaned to the Philadelphia Museum of Art and President Morris reported that Council had approved that this lace be given to the Museum. In addition to this a piece of Japanese tapestry which had belonged to Juliana Wood had been stored in the Society's Hall for some time and Council had voted to present this to the Museum.

President Morris reported that the great lack of funds for publication of scientific material in England had been brought to the attention of the Committee on Publications and that this Committee had voted the sum of \$10,000 to be given to the Royal Society of London for the promotion of science in Britain. However, President Morris stated that he felt, and Council had approved, that this should be a gift from the Society as a whole rather than from a Committee. The following motion recommended by Council was approved:

*Resolved*, that the gift of \$10,000 to the Royal Society for aid to science and learning in Britain be approved; and  
Be it further *Resolved*, that the Committee on Finance be authorized to draw the sum of \$7,500 from the Miscellaneous Fund and the sum of \$2,500 from the General Fund for this purpose.

The Secretary presented the following correspondence between the American Philosophical Society and the Royal Society:

March 21, 1941.

To the Secretaries of  
the Royal Society,

The American Philosophical Society has set aside from its annual budget the sum of \$10,000 to be made available for the aid of science and learning in Britain.

<sup>1</sup> See p. 361.

The President of the Society consulted the office of the British Consulate General in Philadelphia and has just received a letter from the Acting Consul-General, a copy of which is enclosed herewith. This indicates that the Royal Society under its Charter would use this gift for the promotion of natural knowledge. Inasmuch as it was the desire of the American Philosophical Society not only to aid the Royal Society but also to have it distribute part of this sum to those institutions and agencies where it would be most needed a question has arisen whether the Royal Society would undertake this service. In the hope that you may be willing to do this, we are this day cabling to the Royal Society a credit for \$10,000 and we request you to distribute this money where it may be of greatest service to science and learning in Britain.

We make this gift in filial regard for the Royal Society which was the model upon which Benjamin Franklin in 1743 founded "The American Philosophical Society for Promoting Useful Knowledge in the British Plantations in America" and as evidence of the spirit of friendship and common purpose among men of science in both countries.

With assurances of high esteem we are with great respect,

(signed) EDWIN G. CONKLIN,

Executive Vice-President,  
American Philosophical Society.

March 31, 1941.

Dear Mr. President:

The desire of the American Philosophical Society, to help the men of science in this country through the Royal Society, has been so urgent in its friendliness, that our correspondence concerning it has hitherto been conducted entirely by cable. You will already have learned that the cheque for the sum of £2,475 was duly received by the Royal Society on March 26th, only a fortnight after we first learned, through the Foreign Office, of your Society's most generous intention.

In accordance with your cabled indication that the news of this fraternal gift would be made public in America on Sunday, March 30th, I sent a statement in the form of a letter to "The Times" newspaper, with a request for its publication on Monday, March 31st. A copy has also been supplied as a basis for wider publication through official channels.

In my letter to "The Times" I have mentioned the circumstances under which the offer was made and accepted, and have given for the information of readers, a brief, but I hope not inaccurate account of the origin of the American Philosophical Society, with special mention of the fact that its founder, Benjamin Franklin, early created for it a close association with the Royal Society, through his election to our Fellowship. I have fur-

ther made what acknowledgment the space permitted of the peculiarly gracious character of your Society's action. You may be sure that it will be warmly welcomed by all men of science in Britain, and that they will gladly recognize the fine spirit of comradeship which inspired it.

There has yet been no opportunity for a formal report of the matter to the Council of the Royal Society, but I am confident that your Members may be assured in advance, that there will be no difficulty in finding use for their gift, in the promotion of such scientific activity in Britain as they had in mind. At the present time the scientific and technical activities of our country are, of necessity, predominantly employed in connexion with the nation's needs for the conduct of the war; and it is heartening beyond measure to know that those of the United States of America will now be likewise engaged on behalf of the same cause. We do not lose sight of the fact, however, that victory will be barren, unless it preserves for the world, restoring to the countries which have been brutally robbed of it, the freedom of thought and of action required for the unhampered pursuit of knowledge by research, for the benefit of all mankind. This is, in effect, the purpose proudly declared by both our Societies. We are aware that one of the cares of the Royal Society should be to keep alive, even under the stress of our nation's tremendous need and responsibility, a sufficient measure of these normal and beneficent activities, to prepare for their full and rapid resumption when peace returns. Your Society's generosity will therefore be welcomed by Britain's men of science, not only for the direct and intrinsic value of the gift, but also, and even more, for the evidence which it brings of the desire of their American friends to help and to encourage them, even amid the proper and insistent claims of a nation at war, to preserve the spirit and the aim of all true science. It cannot, I think, be doubted that this friendly and gracious action will stimulate, in the men of science in both our countries, that spirit of cooperation in the furtherance of common ideals, which means now so much for the future of the world.

I beg that you will kindly transmit, to the members of the American Philosophical Society, my heartfelt acknowledgement on behalf of the Royal Society.

(signed) H. H. DALE,  
President, Royal Society.

President Morris reported that the Walter Wood Estate had yielded much better returns than had been expected. The mortgage of about \$400,000 had been reduced to \$20,000 and the Estate now yielded about \$15,000 or \$16,000 a year net.

Mr. Morgan, Chairman of the Committee on Finance, presented the Treasurer's report which is published in the YEAR BOOK.<sup>1</sup> This was accepted and approved. The Minutes of the meetings of the Committee on Finance since the last Council Meeting were presented and approved.

Dr. Schramm, Chairman of the Committee on Publications, presented his report and called attention to the fact that the establishment of an Editorial Board for the purpose of considering manuscripts had given the Committee much more opportunity to consider matters of policy. The Editorial Board consists of

Edwin G. Conklin, *Editor-in-Chief*  
Karl K. Darrow, *Editor for Class I*  
David H. Tennent, *Editor for Class II*  
Ernest M. Patterson, *Editor for Class III*  
Rhys Carpenter, *Editor for Class IV*  
Arthur W. Goodspeed, *Managing Editor*.

Upon the death of Dr. Tennent, Merkel H. Jacobs was appointed to the Editorship for Class II.

Dr. Schramm presented an analysis of the results of the questionnaire<sup>2</sup> concerning the form of the PROCEEDINGS which was sent out in June 1940 to all members of the Society. As a result of this, the Committee on Publications felt that the Society should continue to issue the PROCEEDINGS in a single series rather than to break it down into two, three or four series roughly representing the Classes of the Society.

Dr. Schramm stated that the Committee on Publications, after considering the matter very carefully, had voted to recommend that the format of the TRANSACTIONS be changed to a two-column page with 10 point type on 11 lead, the size of the page remaining the same, and that the format of the PROCEEDINGS be changed to a two-column page with 10 point type on 11 lead and that the page size be 8 by 10½ inches. The recommendation concerning the TRANSACTIONS was unanimously approved by Council and that concerning the PROCEEDINGS was approved by a majority vote. It was stated that this change would cause a considerable saving in the cost of publication. After much discussion, a vote was taken and

<sup>1</sup> YEAR BOOK, Amer. Philos. Soc. for 1940: 294-317.

<sup>2</sup> See YEAR BOOK, Amer. Philos. Soc. for 1940: 80.

the following recommendation was approved, thirty-nine voting in favor and thirty-six against it:

*Resolved*, that the format of the PROCEEDINGS be changed to a two-column page with 10 point type on 11 lead, with page size 8 by 10½ inches.

Dr. Farrand presented the report of the Special Committee on the Library, which was distributed in printed form; he stated that the Special Committee wished to present the following recommendations:

*Resolved*, that the Library Committee be requested to reconsider carefully all of the Library's holdings, and particularly the whole list of serial publications, in the light of the list of duplications with other libraries in Philadelphia. In view of the fact that the American Philosophical Society Library is used mostly by non-members, for whom other libraries are more conveniently located, the Library Committee be urged to decrease the number of volumes on the shelves, and reduce drastically the number of continuations, especially those that are kept at the American Philosophical Society Library. To assist it in making such reductions the Library Committee be empowered to dispose of less important items and series and to place some more important ones on loan in other libraries, where their safekeeping may be assured and their use will be greater than in their present location.

*Resolved*, that the Library Committee be urged, in selecting fields and subjects for cultivation, to insist even more rigidly than in the past upon choosing those capable of development to a point of superiority, so that the material when gathered may be used by advanced students in productive research.

The above recommendations, together with the recommendation that the Library should remain housed in the Drexel Building, were approved, questions for action to be left to the discretion of the Library Committee.

The following Committee on Finance was nominated by the President and elected for the year 1941-42:

|                                     |                       |
|-------------------------------------|-----------------------|
| Marshall S. Morgan, <i>Chairman</i> | John Story Jenks      |
| Morris Duane                        | Roland S. Morris      |
| Thomas S. Gates                     | Charles J. Rhoads     |
| Edward Hopkinson, Jr.               | J. Henry Scattergood. |

The Committee on Finance will also serve as the Committee on Building Fund.

President Morris announced the names of those persons elected by Council or appointed to serve on the Standing Committees of the Society for the coming year.

President Morris also stated that a special committee of the Council had been appointed to serve with the Chairmen of the Committees on Membership on "Council Nominees" and that this committee consisted of the following members:

Waldo G. Leland, *Chairman*  
Harlow Shapley  
Ross G. Harrison.

The President further stated that a special committee consisting of the Executive Officer and the Chairmen of the Committees on Membership had been appointed to consider changes in organization of Classes and methods of election.

*The John F. Lewis Prize*

President Morris stated that Council had approved the award of the John F. Lewis Prize to George Howard Parker, Professor Emeritus of Zoology, Harvard University, for the following work on neurohumors as activating agents, reported to and published by the Society:

"Integumentary Color Changes of Elasmobranch Fishes Especially of *Mustelus*." (Read November 27, 1936. *Proc. Amer. Philos. Soc.*, **77**: 223-247.)

"Melanophore Responses and Blood Supply (Vasomotor Changes)." (Read November 27, 1937. *Proc. Amer. Philos. Soc.*, **78**: 513-527.)

"On the Neurohumors of the Color Changes in Catfishes and on Fats and Oils as Protective Agents for Such Substances." (Read April 18, 1940. *Proc. Amer. Philos. Soc.*, **83**: 379-408.)

Dr. Conklin, Chairman of the Committee on Research, presented his report and gave a brief account of the activities of that Committee.

Dr. Conklin presented the report of the Organizing Committee on Education and Participation in Science. The Society approved the following recommendation of Council:

*Resolved*, that a sum of not more than \$2,000 to meet a conditional grant of the same amount from the Carnegie Corporation



be appropriated by the Society to be dispensed by the Committee on Research for the work of the Committee on Education and Participation in Science.

Dr. Sioussat, Chairman of the Committee on Library, presented his report. The announcement of the retirement of Miss Hanson, the Librarian of the Society, was made and the following motion was approved:

*Resolved*, that the thanks of the Society be given to Miss Laura E. Hanson for her valued service, faithfully and tirelessly rendered for over a quarter of a century.

The following recommendation of Council was, on motion, approved:

*Resolved*, that Miss Hanson be retired with a pension for life.

Dr. Sioussat stated that the Library Committee would try to make more adequate arrangements for the safe-keeping of the Society's most valuable possessions, manuscripts and rare books in the present quarters of the Library.

President Morris stated that he had written to the Nominating Committee saying that, being a believer in rotation in office, he felt that he would like to be relieved of the presidency but, upon the Committee's persuasion, he had agreed to serve one more year in order to give the Society sufficient time to consider who should succeed him. President Morris expressed his appreciation of the cooperation of the members and of the delightful experience he had had as President of the Society.

The President stated that Dr. Conklin wished to be relieved of his duties as Executive Officer in the near future and that the Council, after expressing very great appreciation of the service which Dr. Conklin has rendered the Society, had appointed a committee, consisting of Luther P. Eisenhart,<sup>1</sup> *Chairman*, William F. Albright, and Harlow Shapley, to make recommendations for the appointment of a new Executive Officer.

The following motion was approved:

*Resolved*, that the Library Committee and the Committee on Hall be instructed to make plans for the protection of the Society's collections and building against the hazards of war, and that the Finance Committee be authorized to make such expenditures as in its judgment may be necessary to effectuate such plans.

<sup>1</sup> Dr. Eisenhart declined to serve.

The following donations from the collections of her father, Dr. W. W. Keen, were received from Miss Florence Keen:

Steel engraving of W. W. Keen

Framed photograph of a portrait of Carl Linné

Plaque (plaster) of Guglielmo Ferrero by R. Tait McKenzie

*Annual Election*

The Society proceeded to the election of officers and members. Elmer D. Merrill and Morris Duane acted as Judges and William H. Wright as Clerk of Election.

The tellers subsequently reported that the following officers and members had been duly elected:

OFFICERS

*President*

Roland S. Morris

*Vice-Presidents*

Edwin G. Conklin

William E. Lingelbach

Frank Aydelotte

*Secretaries*

W. F. G. Swann

Benjamin D. Meritt

*Curator*

Albert P. Brubaker

*Treasurer*

Fidelity-Philadelphia Trust Company

*Councillors*

(To serve for three years)

Herbert E. Ives, *Class I*

Ross G. Harrison, *Class II*

Joseph H. Willits, *Class III*

William Bell Dinsmoor, *Class IV*

## MEMBERS

## CLASS I—MATHEMATICAL AND PHYSICAL SCIENCES

*Resident*

Griffith Conrad Evans, Berkeley, Calif.  
Henry Eyring, Princeton, N. J.  
Louis Frederick Fieser, Cambridge, Mass.  
John Robert Kline, Swarthmore, Pa.  
Isidor Isaac Rabi, New York, N. Y.  
John Torrence Tate, Minneapolis, Minn.  
Theodor von Kármán, Pasadena, Calif.

*Foreign*

Ronald Aylmer Fisher, London, England  
Ejnar Hertzsprung, Leiden, Netherlands  
Theodor Svedberg, Upsala, Sweden

## CLASS II—GEOLOGICAL AND BIOLOGICAL SCIENCES

*Resident*

Fay-Cooper Cole, Chicago, Ill.  
Evarts Ambrose Graham, St. Louis, Mo.  
Albert Baird Hastings, Brookline, Mass.  
Walter Samuel Hunter, Providence, R. I.  
Charles William Metz, Philadelphia, Pa.  
William Jacob Robbins, New York, N. Y.  
Lewis John Stadler, Columbia, Mo.  
William Hay Taliaferro, Chicago, Ill.

*Foreign*

August Krogh, Copenhagen, Denmark  
Sir D'Arcy Wentworth Thompson, St. Andrews, Scotland

## CLASS III—SOCIAL SCIENCES

*Resident*

Robert Treat Crane, New York, N. Y.  
Manley Ottmer Hudson, Cambridge, Mass.  
Lindsay Rogers, New York, N. Y.  
Arthur Meier Schlesinger, Cambridge, Mass.  
Thomas Jefferson Wertenbaker, Princeton, N. J.  
Leo Wolman, New York, N. Y.

*Foreign*

William E. Rappard, Geneva, Switzerland

## CLASS IV—HUMANITIES

*Resident*

Carl William Blegen, Cincinnati, Ohio  
 Howard Mumford Jones, Cambridge, Mass.  
 Alfred Louis Kroeber, Berkeley, Calif.  
 Lewis Mumford, Amenia, N. Y.  
 Marjorie Hope Nicolson, New York, N. Y.  
 Arthur Darby Nock, Cambridge, Mass.  
 Ephraim Avigdor Speiser, Philadelphia, Pa.

*Foreign*

Harold Idris Bell, London, England  
 Arnold Joseph Toynbee, London, England

## COUNCIL NOMINEES

Andrew Ellicott Douglass, Tucson, Ariz.  
 George William McClelland, Philadelphia, Pa.

**3. AUTUMN GENERAL MEETING, NOVEMBER**

**21, 22, 1941**

Seventy-five members and approximately one hundred guests attended the meeting and twenty-three papers were read.<sup>1</sup>

The following recently elected members subscribed the laws and were admitted into the Society: Joseph Perkins Chamberlain, Robert Treat Crane, John Robert Kline, William Jacob Robbins, Lindsay Rogers, and Thomas Jefferson Wertenbaker.

*Saturday, November 22, 9:30 A.M.*

**EXECUTIVE SESSION**

Roland S. Morris, President, in the Chair

The list of members deceased<sup>2</sup> since the previous meeting was announced by President Morris, while the members present stood as a mark of esteem and respect.

<sup>1</sup> See p. 52.

<sup>2</sup> See p. 361.

Copies of the Treasurer's Report were circulated and Mr. Morgan gave an account of the activities of the Committee on Finance. The budget for the year 1942 as recommended by Council was unanimously approved.<sup>1</sup> President Morris expressed the Society's thanks to the Committee on Finance for the excellent work it is doing.

Dr. Conklin, Chairman of the Committee on Research, presented a summary of the grants awarded to date and expressed his thanks to the Committee for the splendid work it is doing in this connection. Meetings of this Committee are held five times a year on alternate months from October to June and Dr. Conklin stated that the members come to each meeting prepared to spend a full day devoted entirely to the consideration of the applications for grants-in-aid.

Dr. Conklin, as Chairman of the Committee on Meetings, reported on the next Midwinter Meeting, February 13 and 14, 1942, which is to be devoted to the origin and early history of science and learning in America, and he announced a list of members and others who had agreed to take part in this program.

The Committee on Meetings recommended that a special committee be appointed to make arrangements for the celebration of the two hundredth anniversary of the birth of Thomas Jefferson, third President of this Society, which will occur on April 13, 1943. This was unanimously approved and the following committee appointed with power:

Roland S. Morris, *Chairman*

Gilbert Chinard

St. George L. Sioussat

Frederic A. Delano

Charles Warren

S. A. Mitchell

Thomas J. Wertenbaker.

The dates of the Annual General Meeting, April 23-25, 1942, were formally approved.

Dr. Chinard reported on the work that was started by the French botanist, André Michaux (1746-1802), and stated that a nursery which was established by him in 1786 is thirty miles northwest of Charleston and that this and the grove of Magnolia trees and other species probably planted by Michaux and his son, François André, are in danger of being absorbed by the airport which is nearby. It was the sense of the meeting that Dr. Chinard be re-

<sup>1</sup> See p. 248.

quested to go to Charleston and consult the authorities there with respect to possible steps to be taken for the preservation of the nursery. The following resolution was approved:

*Resolved*, that such money be appropriated as would be necessary to enable Dr. Gilbert Chinard to go to Charleston in December to consult with the authorities concerning the Michaux nursery so that plans could be submitted to the Council at its meeting, January 24, 1942.

Dr. MacNider stated that he knew the people in Charleston were very much interested in the preservation of the Michaux nursery and that he felt they would be willing to make some contribution toward this project.

Dr. Schramm, Chairman of the Committee on Publications, reported that two matters are most actively under consideration by the Committee. (1) The task of getting competent opinions on the manuscripts received: it is often necessary for the Board of Editors to get additional advice and the members of the Committee on Publications have expressed a willingness to cooperate with the Editorial Board whenever they can in giving advice or securing opinions regarding the advisability of accepting papers in their particular fields. (2) The distribution of the publications and their list prices are under consideration but no report is ready at this time.

## V

### REPORTS OF STANDING COMMITTEES

#### 1. REPORT OF THE COMMITTEE ON MEETINGS

The Committee on Meetings for the year 1941-42 consists of Roland S. Morris, *President*, Edwin G. Conklin, *Chairman*, Karl K. Darrow, Waldo G. Leland, William E. Lingelbach, John A. Miller, Edward S. Corwin, Henry Norris Russell, Wendell M. Stanley and Douglas Johnson. During 1941 the Committee held four meetings, namely on March 19, May 21, October 15 and December 17.

The Committee in some cases proposed and in all instances approved the programs which were arranged for the three meetings of the year. However, it is glad to recognize the assistance given by others, not members of the Committee, in organizing some of the special features of these meetings. This refers particularly to the Midwinter Meeting on Alexander Dallas Bache and the Centenary of his Magnetic Observatory at Girard College, together with the Symposium on Geophysics, in all of which we had the invaluable aid of Dr. John A. Fleming, Director of the Laboratory of Terrestrial Magnetism of the Carnegie Institution of Washington, and Captain N. H. Heck, Chief, Division of Geomagnetism and Seismology of the United States Coast and Geodetic Survey. In addition to the institutions represented by these persons, we acknowledge with thanks the cooperation of Girard College through its President, Merle M. Odgers, and its Staff and Trustees.

Especial thanks are likewise due to Dr. Serge Korff, formerly of the Bartol Foundation of the Franklin Institute, and now Assistant Professor of Physics at New York University, for his assistance in getting up the program of Reports on the Antarctic Expedition of 1939-1941 for the Autumn Meeting.

## REGULAR MEETINGS OF THE SOCIETY

MIDWINTER MEETING, FEBRUARY 14, 15, 1941

MEETING IN COMMEMORATION OF THE LIFE AND WORK  
OF ALEXANDER DALLAS BACHE, AND SYMPOSIUM  
ON GEOMAGNETISM

With the Cooperation of  
The American Philosophical Society  
United States Coast and Geodetic Survey  
Department of Terrestrial Magnetism,  
Carnegie Institution of Washington  
Girard College

*Friday, February 14, 10:30 A.M.*

ROLAND S. MORRIS, President, in the Chair

## ALEXANDER DALLAS BACHE

## AND HIS CONNECTIONS WITH

- "The American Philosophical Society." Edwin G. Conklin, Vice-president, American Philosophical Society.
- "The University of Pennsylvania." Edward P. Cheyney, Professor Emeritus of European History, University of Pennsylvania.
- "The Franklin Institute of the State of Pennsylvania." Henry Butler Allen, Secretary and Director, The Franklin Institute of the State of Pennsylvania.
- "The United States Coast and Geodetic Survey, and His Scientific Contributions." L. O. Colbert, Director, United States Coast and Geodetic Survey.
- "The National Academy of Sciences, as Founder, First President and Benefactor." Frank B. Jewett, President, National Academy of Sciences.

Instruments, models, manuscripts and books used by Alexander Dallas Bache were on exhibition in the Members' Room.

*Friday, February 14, 2 P.M.*

W. F. G. SWANN, Secretary, in the Chair

## SYMPOSIUM ON GEOMAGNETISM

## PRESENT STATUS AND PROBLEMS

- "Terrestrial Electricity in Relation to Geomagnetism." O. H. Gish, Assistant Director, Department of Terrestrial Magnetism, Carnegie Institution of Washington.



- "Magnetic Survey of the United States." N. H. Heck, Chief, Division of Geomagnetism and Seismology, United States Coast and Geodetic Survey.
- "The Significance of Fossil Magnetism." A. G. McNish, Department of Terrestrial Magnetism, Carnegie Institution of Washington.
- "Relation of Geomagnetism to Geologic Structure." E. A. Eckhardt, Assistant Director, Gulf Research & Development Company.
- "Geomagnetic Observatories and Instruments." H. E. McComb, Chief, Section of Observatories and Equipment, United States Coast and Geodetic Survey.
- "Magnetic Work at Sea." H. Freeborn Johnston, Chief, Section of Observatory Work, Department of Terrestrial Magnetism, Carnegie Institution of Washington.

*Friday, February 11, 8:30 P.M.*

#### EVENING LECTURE

"Geomagnetism: World-Wide and Cosmic Aspects with Especial Reference to Early Research in America." John A. Fleming, Director, Department of Terrestrial Magnetism, Carnegie Institution of Washington.

The lecture was followed by a reception.

*Saturday, February 15, 10:30 A.M.*

LYMAN J. BRIGGS, Director, National Bureau of Standards, in the Chair

#### SYMPOSIUM (continued)

- "Aurora and Geomagnetism." Carl W. Gartlein, Curator, Department of Physics, Cornell University.
- "Contributions of Ionospheric Research to Geomagnetism." L. V. Berkner, Department of Terrestrial Magnetism, Carnegie Institution of Washington.
- "A Radio Anomaly Associated with Geomagnetic Storminess." J. H. Dellinger, Chief of the Radio Section, National Bureau of Standards.
- "Correlations of Short-Wave Radio Transmission Across the Atlantic and Magnetic Conditions." H. E. Hallborg, Research Engineer, R.C.A. Communications, Inc.
- "Cosmic Rays and Geomagnetism." Thomas H. Johnson, Assistant Director, Bartol Research Foundation of the Franklin Institute of the State of Pennsylvania.

*Saturday, February 15, 2:30 P.M.*

*Girard College Chapel*

MERLE M. ODGERS, President, Girard College, in the Chair

"Introductory Address: Bache as an Educator." Merle M. Odgers.  
"Magnetism and Its Uses." Paul R. Heyl, Physicist, National Bureau of Standards.

"Closing Remarks." Roland S. Morris, President, American Philosophical Society.

Musical selections were presented by the Girard College Junior Choir and the Girard College Choir.

Following the afternoon sessions the guests were invited to inspect the grounds and buildings of Girard College.

#### ANNUAL GENERAL MEETING, APRIL 24, 25, 26, 1941

*Thursday, April 24, 10:30 A.M.*

EDWIN G. CONKLIN, Vice-president, in the Chair

Charles P. Olivier, Director of the Flower and Cook Observatories and Professor of Astronomy, University of Pennsylvania.  
"Long Enduring Meteor Trains."

Arthur H. Compton, Professor of Physics, University of Chicago.  
"Recent Studies of Cosmic Rays at High Altitudes."

John H. Northrop, Member, Rockefeller Institute for Medical Research, Princeton. "Crystalline Diphtheria Antitoxin."

Wendell M. Stanley, Member, Rockefeller Institute for Medical Research, Princeton. "On Some Reactions of Tobacco Mosaic Virus."

George Gaylord Simpson, Associate Curator of Vertebrate Paleontology, American Museum of Natural History. "Quantum Effects in Evolution."

Douglas Johnson, Professor of Physiography, Columbia University.  
"New Light on the Origin of the Carolina 'Bays.'"

William B. Scott, Professor Emeritus of Geology and Paleontology, Princeton University. "The Oligocene Mammalia of the White River (final report)."

*Thursday, April 24, 2 P.M.*

ELMER D. MERRILL in the Chair

Olin E. Nelsen,\* Assistant Professor of Zoology, University of Pennsylvania. (Introduced by Dr. J. P. Moore.) "Certain Aspects of Induced Ovulation in the Opossum."

\* Recipient of Grant from the Research Funds.

George Howard Parker, Professor Emeritus of Zoology, Harvard University. "Limited Responses of Melanophores as Determined by Activating Agents."

Charles B. Davenport, Research Associate, Carnegie Institution of Washington. "Self Sculpturing of Bone."

George H. Shull, Professor of Botany and Genetics, Princeton University. "New Mutational Segregations from *Oenothera mut. Erythrina de Vries*."

Carl F. Schmidt, Professor of Pharmacology, University of Pennsylvania. (Introduced by Dr. A. N. Richards.) "The Mechanism and Probable Significance of the Convulsions Produced by Cyanide."

Balduin Lucké, Professor of Pathology, University of Pennsylvania, and Hans G. Schlumberger. (Introduced by Dr. A. N. Richards.) "The Growth of Cancer as Observed Experimentally in the Anterior Chamber of the Frog's Eye." (Read by Dr. Schlumberger.)

*Thursday, April 24, 8:15 P.M.*

HENRY NORRIS RUSSELL in the Chair

#### FRANKLIN MEDAL LECTURE

"Large Molecules Through Atomic Spectacles." Hugh S. Taylor, David B. Jones Professor of Chemistry, Princeton University.

The lecture was followed by round table parties.

*Friday, April 25, 9:30 A. M.*

#### EXECUTIVE SESSION<sup>1</sup>

*Friday, April 25, 11:30 A.M.*

ROLAND S. MORRIS, President, in the Chair

#### SYMPOSIUM ON RECENT ADVANCES IN PSYCHOLOGY

Karl Spencer Lashley, Research Professor of Neuropsychology, Harvard University. "Correlated Developments in Neurology and Psychology."

Arnold Gesell, Professor of Child Hygiene, Yale Graduate School, and Director, Clinic of Child Development, Yale School of Medicine. "The Genesis of Behavior Form in Fetus and Infant."

<sup>1</sup> See p. 33.

*Friday, April 25, 2 P.M.*

J. McKEEN CATTELL in the Chair

**SYMPOSIUM** (Continued)

Wolfgang Köhler, Professor of Psychology, Swarthmore College.  
"The Nature of Associations."

Edward L. Thorndike, Professor of Educational Psychology, Teachers College, Columbia University. "Mental Abilities."

Carney Landis, Associate Professor of Psychology, Columbia University; Principal Research Psychologist, New York State Psychiatric Institute and Hospital. "Psychoanalysis and Scientific Method."

Robert M. Yerkes, Professor of Psychobiology, Yale School of Medicine. "Psychology and Defense."

*Friday, April 25, 8:30 P.M.*

ROLAND S. MORRIS, President, in the Chair

**THE R. A. F. PENROSE, JR., MEMORIAL LECTURE**

"Motivation, Learning and Adjustment." Edward C. Tolman,  
Professor of Psychology, University of California.

The lecture was followed by a reception.

*Saturday, April 26, 10 A.M.*

WILLIAM E. LINGELBACH, Vice-president, in the Chair

O. Neugebauer, Professor of Mathematics, Brown University. (Introduced by Dr. Veblen.) "Egyptian Planetary Texts."

Harald Ingholt, Professor of Semitics and Old Testament, University of Aarhus, Denmark. (Introduced by Dr. Albright.) "The Syro-Hittite Civilization in the Light of the Excavations at Hamath on the Orontes."

Samuel N. Kramer, Research Associate, Oriental Institute, University of Chicago; Guest at the University Museum, University of Pennsylvania. "Sumerian Literature: A Preliminary Survey of the Oldest Collection of Literary Creations in the World, Inscribed on Clay Tablets Dated Approximately 2000 B.C."

Campbell Bonner, Professor of the Greek Language and Literature, University of Michigan. "The Ship of the Soul on a Group of Grave-Stelae from Terenuthis."

Tucker Brooke, Sterling Professor of English, Yale University. "Some Pre-Armada Propagandist Poetry in England."

*Saturday, April 26, 1 P.M.*

Immediately after luncheon members and guests were taken on a drive to Valley Forge and then to the observatory of the late Gustavus Wynne Cook at Roslyn House, Wynnewood, where they were graciously received by Mrs. Cook.

*Saturday, April 26, 7:30 P.M.*

The annual dinner was held at the Bellevue-Stratford Hotel, President Morris presiding.

Dr. Detlev W. Bronk, Professor of Physiology, Cornell University Medical College, presented Dr. George Howard Parker, Professor Emeritus of Zoology at Harvard University, for the John F. Lewis Prize,<sup>1</sup> consisting of a check and a diploma, for his work on Neurohumors as Activating Agents. Dr. Parker made a brief response in acceptance of this honor.

The following after-dinner addresses were made:

Harold C. Urey, Professor of Chemistry, Columbia University. "The Rapid Changes in the Chemical Substances of the Human Body."

Frank Aydelotte, Director, Institute for Advanced Study. "The Internationalism of Learning and the Recent Gift of \$10,000 from the American Philosophical Society to the Royal Society of London for Promotion of Science in Britain."<sup>2</sup>

Robert A. Millikan, Director, Norman Bridge Laboratory of Physics, California Institute of Technology. "Democracy of Science and the Duty of Scientists in this World Crisis."

## AUTUMN GENERAL MEETING, NOVEMBER 21, 22, 1941

*Friday, November 21, 10 A.M.*

ROLAND S. MORRIS, President, in the Chair

### REPORTS ON THE SCIENTIFIC RESULTS OF THE UNITED STATES ANTARCTIC EXPEDITION, 1939-1941

F. Alton Wade, Senior Scientist, United States Antarctic Service. "Introduction."

Paul A. Siple, Geographer, United States Antarctic Service, and Leader, West Base. "Geographical Discoveries from West Base."

<sup>1</sup> See p. 39.

<sup>2</sup> Published in *Notes and Records of the Royal Society of London*, Vol. 3, 107-109, Sept. 1941.

Lawrence A. Warner, Department of Geology, Johns Hopkins University. "Geologic Structure and Petrography of the Edsel Ford Ranges, Marie Byrd Land, Antarctica."

W. F. G. SWANN, Secretary, in the Chair

F. Alton Wade, Professor of Geology, Miami University. "The Physical Aspects of Shelf Ice."

Herbert G. Dorsey, Jr., United States Weather Bureau. "An Antarctic Mountain Weather Station."

Roy G. Fitzsimmons, Physicist, United States Antarctic Service; Department of Terrestrial Magnetism, Carnegie Institution of Washington. "Preliminary Report on the Magnetic and Seismic Program."

Serge A. Korff, Assistant Professor of Physics, New York University, E. T. Clarke and D. K. Bailey. "Report on Cosmic Ray Results."

*Friday, November 21, 2 P.M.*

WILLIAM E. LINGELBACH, Vice-president, in the Chair

Arnold Court, Junior Meteorologist, United States Weather Bureau. "Winter Disappearance of the Antarctic Tropopause."

Herwil M. Bryant, Naval Research Laboratory, Anacostia Station, Washington, D. C. "Biology at East Base."

J. E. Perkins, Biologist, United States Biological Survey. "Biology of the West Base Region." (Read by title.)

Ernest E. Lockhart, Physiologist, United States Antarctic Service; Department of Biology and Public Health, Massachusetts Institute of Technology. "Physiological Problems at West Base."

Richard H. Black, Field Representative, United States Antarctic Service. "Operations in Palmer Land." (Read by Mr. Dorsey.)

William B. Scott, Professor Emeritus of Geology, Princeton University. "Presentation of the Completed Monograph on the White River Mammalia." (Read by title.)

*Friday, November 21, 8:30 P.M.*

President Morris requested William H. Hobbs, Professor Emeritus of Geology, University of Michigan, to take the Chair.

#### EVENING LECTURE

"Military Aspects of the Arctic." Vilhjalmur Stefansson, Arctic Explorer; Past President of the Explorers Club.

The lecture was followed by a reception.

*Saturday, November 22, 9:30 A.M.*

EXECUTIVE SESSION<sup>1</sup>

*Saturday, November 22, 10:30 A.M.*

EDWIN G. CONKLIN, Vice-president, in the Chair

William J. Robbins, Director, New York Botanical Garden; Chairman, National Science Fund of the National Academy of Sciences. "The National Science Fund."

Lester W. Strock,<sup>\*</sup> Geochemist, Research Laboratory, Saratoga Springs Commission. "The Geochemical Genesis of Saratoga Mineral Waters and the Spectrochemical Analysis of Their Characteristic Trace Elements."

Carl G. Vinson,<sup>1</sup> Professor of Horticulture, University of Missouri. "Isolation of Crystalline Tobacco Mosaic Virus Protein, Using Water Miscible Solvents."

Leslie A. Chambers<sup>1</sup> and Werner Henle, Department of Pediatrics and the Johnson Foundation for Medical Physics, University of Pennsylvania. "Concentration, Isolation, and Determination of the Size of the Virus of Influenza A."

Herbert Shapiro,<sup>2</sup> Instructor in Physiology, Hahnemann Medical College, Philadelphia. "The Parthenogenetic Activation of Rabbit Eggs in the Unoperated Animal."

Francis Harper,<sup>3</sup> Research Associate, the John Bartram Association, Philadelphia. "William Bartram's Status as a Naturalist."

Vladimir J. Fewkes,<sup>4</sup> Archaeologist and Technologist, University Museum, University of Pennsylvania. "Methods and Techniques of Pottery Making Among North American Indians." (Read by title.)

Helen C. Palmatary,<sup>\*</sup> Teacher, Kensington High School, Philadelphia. "Recent Archaeological Studies in Amazonia."

Charles Grosvenor Osgood,<sup>1</sup> Professor Emeritus of English, Princeton University. "The Variorum Edition of the Works of Edmund Spenser, Especially of the Minor Poems."

Leonard G. Rowntree, Chief, United States Medical Division, Selective Service. "The Health of Registrants and the President's Plan for Rehabilitation."

SPECIAL MEETINGS AND RECEPTIONS

*December 8, 4 P.M.* TEA FOR THE VISITING STUDENTS FROM THE REPUBLIC OF COLOMBIA.

A group of students from the Republic of Colombia who were making special studies at the University of Pennsylvania for a

<sup>1</sup> See p. 43.

<sup>\*</sup> Recipient of Grant from the Research Funds.

period of six weeks during December and January, under the leadership of Dr. Rodriguez of the National University, Bogotá, were taken on a tour of the Society's Hall and Library and were entertained at tea.

## MEETINGS OF OTHER ORGANIZATIONS

### THE ARCHAEOLOGICAL INSTITUTE OF AMERICA

The Archaeological Institute of America, Philadelphia Society, has been granted the privilege of holding its meetings for the years 1940-41 and 1941-42 in the Hall of the American Philosophical Society. During 1941 the following lectures were presented:

*January 15, 8:15 P.M.* George Vaillant, Associate Curator, Mexican Archaeology, American Museum of Natural History. "Origins of Middle American Civilization."

*March 19, 8:15 P.M.* Homer A. Thompson, Professor, University of Toronto; Field Director, Excavations of the Athenian Agora. "The Sanctuary of Hephaistos and Athena in Athens."

*April 16, 8:15 P.M.* Jerome Sperling, Yale University. "Homeric Troy."

*October 29, 8:15 P.M.* William B. Dinsmoor, Professor of Archaeology, Columbia University; President, Archaeological Institute of America. "The Temples of Zeus at Olympia."

### THE JAYNE MEMORIAL LECTURES

The Jayne Memorial Lectures for the season of 1941 were presented by Joseph Hudnut, Professor of Architecture and Dean of the Faculty of Design, Harvard University, on the subject of "Architecture and Its Relationship to the Arts of Painting and Sculpture." Two lectures were presented on March 20 and March 27.



## 2. REPORT OF THE COMMITTEE ON HALL

The Committee on Hall for the year 1941-42 consists of the following members: John Story Jenks, *Chairman*, Paul P. Cret, Marshall S. Morgan, Lawrence J. Morris, Francis R. Packard, John M. Scott; and *ex-officio*, Roland S. Morris, *President*; Albert P. Brubaker, *Curator*; and Edwin G. Conklin, *Executive Officer*.

During the year 1941 one meeting of the Committee on Hall was held, on May 29, at which time Dr. Richard H. Heindel of the Library of Congress presented a report on the protection of the Society's collections and building against the hazards of war. This was done in accordance with a recommendation made at the Executive Session of the Society on April 25 that the Committees on Library and Hall make plans for such protection.

There was no occasion of holding other formal meetings but informal meetings of the Chairman and members of the Committee, the President and Executive Officer, have occurred frequently and the building and its contents have been inspected and minor repairs authorized.

With the hope that it might be possible to improve the looks of the two rooms on the second floor by covering or removing unsightly pipes the Finance Committee authorized an inquiry as to plans and cost. Mr. Paul Cret and members of his staff made an inspection and found that it would be necessary to put in new window frames and sashes, fur with lath and plaster all the outer walls, make changes in location of water and steam lines, remove and shorten wall cases, and in general make a great deal of dirt and disturbance throughout the whole building. This conclusion, together with the difficulty of getting labor and material at this time, made it inadvisable to undertake such a major alteration now. After the war, it is hoped that it may be possible to restore the roof to the same general form which it had when built and at the same time to keep most of the present third floor area but without the gallery; at that time the proposed alterations of the second floor should be made.

A change in the grading of the walks in Independence Square adjoining our building, so as to eliminate the low area where water

now collects after heavy rains and then seeps through the Society's basement walls, is most necessary. It has been called to the attention of the Department of Public Works but no action has been taken as yet.

The Committee recommended that portraits of President Morris and Vice-president Conklin be painted by Cameron Burnside.

The original painting of "Franklin at the Court of Louis XVI" by George Peter Alexander Healy was purchased by the Society and hung in the hall shortly before the Autumn Meeting.

This historic painting commissioned by King Louis Philippe perpetuates the eventful scene when Franklin had just brought about the recognition of the new United States by France and the Treaty of Alliance, February 6, 1778. On the throne are Louis XVI and Marie Antoinette. In addition to Franklin, the three American Commissioners, together with Count de Vergennes, Beaumarchais and Cardinal de Rohan are recognizable.

### 3. REPORT OF THE COMMITTEE ON THE LIBRARY

The Committee on the Library has the honor to present the following report for the calendar year 1941.

#### *The Library Committee: Personnel, Meetings and Policy.*

The membership of the Committee consists of St. George L. Sioussat, *Chairman*, George A. Barton, Rhys Carpenter, Waldo G. Leland, William E. Lingelbach, J. Percy Moore, Horace C. Richards, A. S. W. Rosenbach, and Roland S. Morris, *President*; Edwin G. Conklin, *Executive Officer*, sits with the Committee.

Four regular meetings of the Committee, and one special meeting, were held during the year, namely, on March 19, May 21, October 15, November 20, and December 17.

The recommendations made by the Special Committee on Library<sup>1</sup> presented the standing Committee with the problem of formulating plans for the future policy of the Library. Before such a policy could be determined it seemed necessary to make a thorough survey of the Library's holdings. This task was assumed by the Committee members, representing the following classes:

|                                                        |                                     |
|--------------------------------------------------------|-------------------------------------|
| American history including the Indians.....            | St. George L. Sioussat              |
| Biological sciences.....                               | Edwin G. Conklin and J. Percy Moore |
| English history.....                                   | William E. Lingelbach               |
| International law.....                                 | Roland S. Morris                    |
| Learned societies, exclusive of scientific societies.. | Waldo G. Leland                     |
| Mediterranean antiquities.....                         | Rhys Carpenter                      |
| Physical sciences.....                                 | Horace C. Richards                  |

As an aid in these surveys the staff is compiling classified lists of the serials (closed and current files). These show, in addition to this Library's holdings, the duplications in those of the Academy of Natural Sciences, the Franklin Institute, the Free Library, and the University of Pennsylvania.

Although the formulation of a statement of policy by the Committee is still somewhat in the future, a considerable amount of the actual surveying has been completed. Plans slowly evolving tend to limit the scope of the Library to the history of science and culture, with particular stress on the intellectual development of America and the association of the American Philosophical Society, both as an institution and through its individual members, with that growth.

<sup>1</sup> See its Report, p. 275.

For some time before the actual declaration of war between the United States and the Axis powers the Committee had been considering the question of the preservation of the Society's treasures in case of air raids. In conjunction with the Committee on Hall plans are being formed for the removal of certain items and the greater safety of those which will be kept in the Library's quarters.

### *Holdings of the Library.*

At the close of 1941 the total number of volumes in the Library is 101,447 (of which 70,338 are serial publications), of pamphlets 37,471, and of maps 5,808. At the close of 1940 the corresponding figures were: 100,076<sup>1</sup> (of which 69,310 were serials), 36,926 pamphlets, and 5,719 maps.

### *Additions to the Library.*

During 1941 there have been added to the Library 1,371 volumes, of which 1,028 were serials, 545 pamphlets, 89 maps, 4 broadsides, 1 chart, 2 newspaper clippings, 816 prints and engravings, 72 manuscripts, 5 typescripts, 3 photostats and photographs, and 2 microfilms. Of these there have been acquired by gift or exchange 661 volumes, of which 483 were serials, 541 pamphlets, 89 maps, 1 broadside, 1 chart, 2 newspaper clippings, 22 manuscripts, 5 typescripts, 1 photostat, and 2 microfilms. In addition 31 volumes of newspapers were deposited.

The purchases have been on account of the following:

| Funds      | Purpose                                   | Vol. (other than ser.) | Vol. (serials) | Pam. | Map. | Broadsides | Prints | Photo. |
|------------|-------------------------------------------|------------------------|----------------|------|------|------------|--------|--------|
| General    | Unrestricted                              | 88                     | 322            | 4    | 48   |            | 776    | 1      |
| Balch      | International Law                         |                        | 2              |      |      |            |        |        |
| Boyé       | Chemistry and Geology                     |                        | 3              |      |      |            |        |        |
| Carlier    | Unrestricted                              | 10                     | 3              |      |      |            |        |        |
| Franklin   | Unrestricted                              | 25                     | 2              |      | 2    | 3          | 40     |        |
| Jefferson  | Unrestricted                              | 3                      | 3              |      |      |            |        |        |
| Magellanic | Navigation, Astronomy, Natural Philosophy |                        | 10             |      |      |            |        |        |
| Michaux    | Forestry, Botany, Agriculture             | 4                      | 36             |      |      |            |        |        |
| Norris     | Unrestricted                              | 9                      | 2              |      |      |            |        |        |
| Phillips   | Archaeology, Philology                    | 17                     | 153            |      |      |            |        |        |
| Proud      | Unrestricted                              | 9                      | 5              |      |      |            |        | 1      |
| Seybert    | Unrestricted                              |                        | 2              |      |      |            |        |        |
| Tilghman   | Unrestricted                              |                        | 2              |      |      |            |        |        |

<sup>1</sup> Correction of error made in addition in last year's Report.

*Donations to the Library.*

Through the good offices of Dr. Francis R. Packard, the Library Company of Philadelphia presented a copy of the *American Magazine*<sup>1</sup> for 1769. In this journal, edited by Lewis Nicola, an early member of the Society, were issued as monthly supplements, from February through September, the TRANSACTIONS of the Society. This printing of the Society's papers antedated the publication of our present TRANSACTIONS series, Volume 1 of which appeared in 1771. The gift is particularly welcome, inasmuch as three of the papers thus published were not reprinted in the 1771 volume.

Mrs. William P. Gest has again been a generous friend in adding seventy-one volumes from her husband's library to her previous contributions. From the General Electric Company have come twenty-two additional volumes of Elihu Thomson letter-books. This group of the Papers now embodies Professor Thomson's correspondence from 1882 to 1936.

President Morris has added twenty volumes to the lengthy list of his gifts presented over several years. From Mr. Morris Duane, the Society has received on deposit thirty-one volumes of the newspaper, *The Aurora; General Advertiser*, covering the years 1798–1821, published in Philadelphia first by Benjamin Franklin Bache and later by William Duane. This file was owned originally by the editor Duane. Other members of the Society who have made contributions this year include: Harley H. Bartlett, Albert F. Blakeslee, T. D. A. Cockerell, Edwin G. Conklin, Max Farrand, Aleš Hrdlička, Charles R. Morey, Lawrence J. Morris, and A. S. W. Rosenbach.

Among the non-members who have contributed are:

Mrs. Cyrus Adler  
 Frederic Bigelow  
 I Bernard Cohen  
 Robert H. Elias  
 Henry Ridgely Evans  
 George V. Fagan  
 Francis A. Foster  
 S. W. Geiser  
 Mrs. William P. Gest  
 Miecislau Haiman  
 Harry A. Hopf  
 Alban W. Hoopes

Frederic R. Kirkland  
 Henry D. Learned  
 Douglas C. McMurtrie  
 Lawrence Martin  
 Gladys Meyer  
 Abraham Neuman  
 Albert L. Rohrer  
 Bruno Roselli  
 Harlan T. Stetson  
 W. Stephen Thomas  
 Dixon Weeter

<sup>1</sup> Philadelphia, William and Thomas Bradford.

Outstanding among the learned societies, institutions, libraries, and universities which have contributed are:

American Jewish Congress, New York  
Buhl Foundation, Pittsburgh  
Dominion of Canada  
Carnegie Corporation of New York, New York  
Carnegie Endowment for International Peace, Washington, D. C.  
Carnegie Institution of Washington, Washington, D. C.  
Case School of Applied Science, Cleveland  
Central High School, Philadelphia  
Cornell University, Ithaca, New York  
Costa Rica. Centro Nacional de Agricultura, San José  
Dropsie College for Hebrew and Cognate Learning, Philadelphia  
General Electric Company, Lynn, Massachusetts  
Geographical Society of New South Wales, Sydney, Australia  
H. M. Stationery Office, London, England  
Historical and Philosophical Society of Ohio, Cincinnati, Ohio  
Historical Society of Pennsylvania, Philadelphia  
Indian Rights Association, Philadelphia  
Institut Adrien Guébard-Séverine, Neuchâtel, Switzerland  
Instituto Panamericano de Bibliografía y Documentación, Mexico  
Instituto y Observatorio de Marina, San Fernando, Spain  
Inter American Statistical Institute, Washington, D. C.  
Jewish Publication Society, Philadelphia  
John Carter Brown Library, Providence, Rhode Island  
John Rylands Library, Manchester, England  
Laboratoire de Plasmogénie, Mexico  
Library Company of Philadelphia, Philadelphia  
Mellon Institute, Pittsburgh  
Meriden Gravure Company, Meriden, Connecticut  
Metropolitan Museum of Art, New York  
Milbank Memorial Fund, New York  
Museum of Modern Art, New York  
New York Meteorological Observatory, New York  
New York Zoological Society, New York  
Parke-Bernet Galleries, New York  
Penrose Research Laboratory, Philadelphia  
Commonwealth of Pennsylvania  
Pennsylvania Forestry Association, Philadelphia  
Pennsylvania Historical Commission, Harrisburg  
Philadelphia Bibliographical Center and Union Library Catalogue, Philadelphia  
Philadelphia Museum of Art, Philadelphia  
Polish Roman Catholic Union, Chicago  
Rockefeller Foundation, New York  
Royal Observatory, Greenwich, England  
Solar Physics Observatory, Kodaikanal, India

Swarthmore College, Swarthmore, Pennsylvania  
 Union Catalog of Floridiana, Winter Park, Florida  
 United States Government  
 Virginia State Library, Richmond, Virginia  
 Woods Hole Oceanographic Institute, Woods Hole, Massachusetts  
 World Calendar Association, New York  
 Zoological Society of Philadelphia, Philadelphia

To all of these the Committee on the Library extends its appreciation.

*Important Purchases Made by the Library.*

Until definite plans for the future policy of the Library have been formulated, the program of conservative buying inaugurated last year will be continued. This, in addition to the chaotic condition of the world which very seriously limits importations, accounts for the decided decrease in the accessions for 1941.

New titles in the history of science are here given:

- Frisi, Paolo.** Opuscoli filosofici. In Milano, Appresso Giuseppe Galeazzi . . . MDCCLXXXI.
- Geber.** De alchemia, dialogi II. Norimbergae apud Iohan. Petreium, Anno M. D. XLVIII.
- Morin, Jean.** Abregé du mécanisme universel, en discours et questions physiques. A Chartres, Chez J. Roux . . . M. DCCXXXV.
- Müller, Johann,** of Königsberg. . . De cometæ magnitudine, longitudineque ac de loco eius uero, problemata XVI. Norimbergae apud Fridericum Peypus, Anno, D. M. XXXI (sic).
- Nardi, Giovanni.** De igne subterraneo. [Colophon] Florentiae, Excudebant Amator Masta, & Laurentius de Landis, 1641.
- Pardies, Ignace Gaston.** La statique, ou la science des forces mouvantes . . . 2nd ed. A Paris, Chez Sebast. Mabre-Cramoisy . . . M. DCLXXXIV.
- Science in progress,** ed. by G. A. Baitsell. New Haven, Yale University Press . . . 1939.
- Smallwood, William Martin.** Natural history and the American mind, by W. M. Smallwood . . . in collaboration with M. S. C. Smallwood. New York, Columbia University Press, 1941.
- Werner, Joannes.** . . . Syper vigintidvobvs elementis conicis. [Colophon] Impressvm Nvrembergæ per Fridericum Peypus . . . Anno M.D. XXII.

Outstanding purchases made in other fields include a copy of the first edition of the *History of the Expedition under the Command of Captains Lewis and Clark* . . . 1804-1806, published in Philadelphia in 1814. Although on the title page credit is given to Paul Allen for preparing the work for the press, the actual editing was

done by Nicholas Biddle at the request of Capt. William Clark. It was from Mr. Biddle in April 1818 that the Society received the original manuscript journals of the Lewis and Clark expedition.

Advantage was taken of a sale of duplicates offered by the Henry E. Huntington Library to augment the Library's collection of eighteenth century Americana by thirty-one titles. Few of these items were found elsewhere in the Philadelphia area. Another acquisition not found in this vicinity which was ordered at the suggestion of the Academy of Natural Sciences is the *Reports from the Scientific Expedition to the North-western Provinces of China* under the leadership of Dr. Sven Hedin, 1927-1933.

A collection of forty-three letters written by Alexander Dallas Bache (President of the American Philosophical Society from 1855 to 1857) to various persons over the years 1843-1863 was acquired. The correspondence consists chiefly of matters dealing with the United States Coast Survey of which Mr. Bache was superintendent from 1843 until his death in 1867.

The addition of 776 miscellaneous prints and engravings will do much to make the Society's print collection more valuable and useful.

### *Frankliniana.*

From the Gribbel sale the Society purchased a letter, of considerable scientific interest, from Benjamin Franklin to John Winthrop, noted American astronomer, dated December 23, 1762, and pertaining to the Transit of Venus in 1761. On the same sheet are two rough drafts of letters by Winthrop, one to Franklin, January 20, 1763, and the other to [James?] Short, June 6, 1764. Three other holograph Franklin letters were acquired during the year—two to his partner in the printing business, David Hall, under dates of December 9, 1757, and November 9, 1765, and the third to John Balfour, of London, April 2, 1761, relative to David Hall. A certificate of membership issued by the American Philosophical Society to John Ewing, 1786, bearing Franklin's signature as President of the Society was acquired also. One item was added to the Society's collection of material relating to the family of Benjamin Franklin—a letter from Sarah Bache, Franklin's only daughter, to her son, William Bache, September 20, 1794. This is important not only because of its Franklin association but also because of its reference to Dr. Benjamin Rush's opinion of the yellow fever epidemic.



In addition to the manuscript material several printed items were acquired, including two editions of the *Way to Weallh*, one a broadside issued in London about 1780; a 1797 edition of the *Autobiography*; eleven issues of Franklin's *Life and Essays*, including the first English printing of 1793; a facsimile of his *Dissertation on Liberty and Necessity*, London, 1854; and an *Easy Introduction to the Game of Chess*, London, 1813. Mention should be made here also of the new edition of Franklin's *Electrical Experiments* so ably edited by I Bernard Cohen.<sup>1</sup> Dr. Carl Woodward's *Ploughs and Politicks*<sup>2</sup> is also important for clearing up the question of the mysterious "Franklin farm" in Burlington county, New Jersey.

For some time the Library has been building up slowly a collection of Franklin prints; a group of forty has been added this year.

Dr. Dixon Wecter, who has continued his studies on Franklin, has presented copies of two articles recently published—"Thomas Paine and the Franklins,"<sup>3</sup> and "Benjamin Franklin and an Irish 'Enthusiast.'"<sup>4</sup> From Miss Gladys Meyer came *Free Trade in Ideas; Aspects of American Liberalism Illustrated in Franklin's Philadelphia Career*.<sup>5</sup>

### *Acquisition of Serials.*

Although our exchange file lists 176 domestic and 475 foreign institutions, less than fifty per cent of the exchanges with continental Europe were active this year, bringing the number of serial titles received in that way down to 572 as compared with 1,260 in 1940; 151 titles have been received as gifts, and 219 by purchase. Twenty-seven new serials have been added, among which are the following:

### *By Purchase.*

**American antiquity.** V.1 + Menasha, Wis., Society for American archaeology, 1935 +.

**American Ethnological Society.** Monographs. No.1 + New York, 1940 +.

**League of Nations.** Treaty series. V.1-198; indexes, V.1-8. London (and elsewhere), 1920-1939.

**Starye gody.** 1907-1916. Petrograd, 1907-1916.

<sup>1</sup> Cambridge, Mass., Harvard University Press, 1941.

<sup>2</sup> New Brunswick, Rutgers University Press, 1941.

<sup>3</sup> *American Literature* 12: 306-317 (1940).

<sup>4</sup> *Huntington Library Quarterly* 4: 205-234 (1941).

<sup>5</sup> N. Y., King's Crown Press, 1941.

*By Exchange.*

- Florida Academy of Sciences. Proceedings. V.1 + Gainesville, 1936 +.
- Harvard University. Blue Hill Meteorological Observatory. Blue Hill notes. No. 6 + Cambridge, 1940 +.
- Pan American Institute of Geography and History. Revista geografica. T. 1 + Mexico, 1941 +.
- Royal Society of London. Notes and records. No.1 + London, 1938 +.
- University of Nebraska. Studies in the humanities. No. 1 + Lincoln, 1941 +.
- University of Toronto. Studies—Orientals. No. 1 + Toronto, 1931 +.
- University of Toronto quarterly. V. 10 + Toronto, 1940 +.

*By Gift.*

- Boletin bibliografico mexicano. January 1941 + Mexico, 1941 +.
- Jewish affairs. V. 1 + New York, 1941 +.
- Libros cubanos. An. 1 + La Habana, 1940 +.

*Binding, Cataloguing, etc.*

During 1941, 816 volumes have been bound. There have been catalogued 261 books in 529 volumes, 108 pamphlets, 53 manuscripts, 82 charts and maps, 4 microfilms and photostats, and 40 engravings; 6 autographs and 4 bookplates have been noted; 4 titles recatalogued; and 894 serial analytics have been brought out; 4,694 cards have been added to the catalogue, of which 3,837 were L.C. cards and 857 typewritten. A separate author file of material submitted by grantees was compiled, consisting to date of 626 items.

*Restoration of Manuscripts.<sup>1</sup>*

In January Miss M. Barbara O'Neill joined the staff to take charge of the restoration of manuscripts and rare books, thereby resuming the work which had been started several years ago by Mrs. Carolyn Horton. The most important accomplishment of the year was the completion of the repair of 27 Franklin account books which form a part of the Bache Collection. In addition, 93 other items were restored, differing in size from a single page to the volume of Thomas and Richard Penn Correspondence which was taken apart and the 178 individual letters are now in process of being repaired.

<sup>1</sup> Summarized from a report submitted by Miss O'Neill.

*Archives of the Society.*<sup>1</sup>

During the year 1941 the examination and cataloguing of the miscellaneous letters has been nearly completed. To date 1,481 archival and 600 manuscript letters covering the period from 1744 to 1888, and 308 archival and 80 manuscript documents from 1769 to 1898 are catalogued. The bulk of the collection of archival documents is directly connected with the history and growth of the American Philosophical Society. Lists of subscribers to the early volumes of *TRANSACTIONS*, lists of papers submitted for publication, accounts connected with the building of Philosophical Hall, early insurance policies, and many other items form a body of material of great value and unique interest.

Perhaps the most important work of the year has been the effort to determine the amount of material at the Academy of Natural Sciences and the Historical Society of Pennsylvania related to the American Philosophical Society and its members. Mention has been made in an earlier report of the examination of the John K. Townsend papers at the Academy of Natural Sciences. Since that time the Botanical Correspondence of Zaccheus Collins of Philadelphia, 1805-1827, has been studied. This is divided as follows:

1. Letters of Henry Muhlenberg, 1812-1815. 61 pieces.
2. Correspondence with F. A. Muhlenberg, 1815-1816. 27 pieces.
3. Correspondence with Stephen Elliott, 1813-1821. 15 pieces.
4. Letters of Jacob Bigelow, 1814-1818. 19 pieces.

Of these the most interesting letters are in the F. A. Muhlenberg correspondence. This contains material dealing with the purchase of Henry Muhlenberg's herbarium by the American Philosophical Society.

The files of the Historical Society of Pennsylvania contain an almost limitless amount of manuscript material. This has been examined for letters specifically relating to the American Philosophical Society, and to certain members thereof, viz.: Alexander Dallas Bache, Benjamin Smith Barton, Zaccheus Collins, Redmond Conyngham, and Thomas Jefferson. Some examination has also been made of material relating to John Adams, Franklin Bache, Peter S. DuPonceau, and John F. Watson, but this has yet to be completed. Enough has been done, however, to prove that much that is relevant to the history of the Society and to the lives of its members may be found in other libraries than our own.

<sup>1</sup> Summarized from a report submitted by Dr. Alban W. Hoopes.

*Photoduplication Service.*<sup>1</sup>

The Photoduplication Service has filled 98 outside orders comprising 5,208 frames of microfilm, 483 enlargement prints and 3 lantern slides; receipts amounted to \$230.60. Work done for the Society amounted to about 5,100 frames.

In connection with the measures being taken to protect our treasures against bombing, the Committee decided to have the entire collection of Franklin Papers filmed. To date that group of the Papers known as the Bache Collection has been completed, amounting to nearly 5,000 frames, and a beginning has been made on the original collection which, it is estimated, will total more than 50,000 frames.<sup>2</sup> In order to film more efficiently this sizeable amount of material it was found necessary to improve mechanical techniques and to standardize photographic procedure. Several additions to and changes in the equipment were made, including a better lens, the substitution of 110-volt reflector lamps for the original photo-flood illumination, the use of a variable transformer to control illumination, the development of a book-cradle, the installation of a cypress sink and insulated constant-temperature tanks in the dark-room, and the purchase of an S.V.E. portable reading machine.

*In-Use and Out-Use of the Library.*

During 1941 there were 563 recorded visitors to the Library; 535 of these actually consulted material, using 1,896 printed and 453 manuscript items. In addition replies were made to about 100 inquiries received by mail. Twenty-four volumes were lent to members, 99 to the staff, and 447 upon the interlibrary loan; 151 volumes were borrowed upon the interlibrary loan.

Although there was an increase of only about ten per cent in the number of readers this year over last, we point with a certain amount of satisfaction to the added service we are rendering by means of the interlibrary loan and the photoduplication service. One hundred and eight loans were made in 1941 to 38 different institutions in comparison with 61 to 20 institutions last year. Two of these loans merit special mention: to the Brown University, Providence, Rhode Island, the Library has lent 187 volumes dealing principally with Assyriology, for the college term 1941/42, and to the Egyptian Department of the University of Pennsylvania have

<sup>1</sup> Summarized in part from a report submitted by Dr. John J. Heilemann.

<sup>2</sup> Entire collection completed March 1942.

gone 77 volumes for use during the current school year. Photoduplication orders have risen from 74 in 1940 to 98 in 1941.

*Exhibits of Books and Manuscripts.*

Midwinter Meeting, February 14-15, 1941.

Material in commemoration of the life and work of Alexander Dallas Bache.

Jayne Memorial Lectures, Delivered by Professor Joseph Hudnut on Architecture and its Relationship to the Arts of Painting and Sculpture, March 20 and 27, 1941.

Material relating to early American architecture.

Annual General Meeting, April 24-26, 1941.

Material representing the early activities and interests of the Society.  
Works by women members of the Society.

Summer Exhibition, June 23-November 18, 1941.

Books from the library of Thomas Jefferson.

Autumn General Meeting, November 21-22, 1941.

Material relating to polar exploration.

Early illustrated works in natural history.

In addition to the above-mentioned exhibitions which were held in either the Library's quarters or the Hall of the Society, the Society lent nine items of Frankliniana for a rare book exhibit at the Philadelphia Book Fair which was held in the Bellevue-Stratford Hotel on October 5-7, 1941, under the sponsorship of the Philadelphia *Record* and the Booksellers' Association.

*Staff.*

After more than twenty-five years of devoted service Miss Laura E. Hanson was retired as Librarian, as of September 1.<sup>1</sup> The year saw also the resignation of Dr. John J. Heilemann, as of October 15, to take a teaching position in the physics department at Ursinus College.

At the close of the year, the staff consists of Mrs. Gertrude D. Hess, *Assistant Librarian*; Mrs. Ruth A. Duncan; Mrs. Mary C. Dothard; Dr. Alban W. Hoopes, for archival work; Miss M. Barbara O'Neill, for restoration of manuscripts; and Mr. George Thomas Garver, Jr., for the photoduplication service.

<sup>1</sup> See p. 40.

*Financial Statement.**Books and Binding and General Expenses.*

|                                 |                       |
|---------------------------------|-----------------------|
| Carried forward from 1940 ..... | \$ 5,324.60           |
| Appropriation for 1941 .....    | 7,000.00              |
|                                 | \$12,324.60           |
| Expended during 1941 .....      | 5,575.28 <sup>1</sup> |
| Balance 12/31/41 .....          | \$ 6,749.32           |

*Special Library Funds.*

| Balances         |            |            | Transferred  | Balances    |
|------------------|------------|------------|--------------|-------------|
| 1/1/41           | Income     | Expended   | to Principal | 12/31/41    |
| \$14,694.54      | \$8,129.50 | \$2,020.62 | \$4,108.92   | \$16,694.50 |
| <i>Salaries.</i> |            |            |              |             |
| For 1941 .....   |            |            |              | \$ 9,982.50 |

<sup>1</sup> Includes the salary of the restorer of manuscripts.

#### 4. REPORT OF THE COMMITTEE ON PUBLICATIONS

The Committee on Publications for the year 1941-42 consists of the following members: Jacob R. Schramm, *Chairman*, Frank Aydelotte, Edwin G. Conklin, Franklin Edgerton, Benjamin D. Meritt, John A. Miller, Ernest M. Patterson, Conyers Read, Harold C. Urey, James T. Young, Roland S. Morris, *President*, and Arthur W. Goodspeed, *Editor*. The Editorial Board is as follows:

|                        |                        |
|------------------------|------------------------|
| Edwin G. Conklin       | <i>Editor-in-Chief</i> |
| Karl K. Darrow         | <i>Editor—Class I</i>  |
| Merkel H. Jacobs       | <i>Class II</i>        |
| Ernest Minor Patterson | <i>Class III</i>       |
| Rhys Carpenter         | <i>Class IV</i>        |
| Arthur W. Goodspeed    | <i>Managing Editor</i> |

During the year 1941 four regular meetings of the Committee were held, namely on February 22, April 5, October 4 and December 6, and one special meeting on April 23 to consider the advisability of changing the format of the TRANSACTIONS and the PROCEEDINGS and to recommend to the Council and the Society for final action any proposals which the Committee might submit concerning this matter.

After a study of the PROCEEDINGS and the TRANSACTIONS had shown that the printing costs could be reduced very substantially by adjustments in format and typography, the Committee recommended such changes, which were adopted by the Society at the Annual Meeting on April 25 and put into effect with Vol. 32 of the TRANSACTIONS and Vol. 85 of the PROCEEDINGS.

The Editorial work of the Executive Officer is increasing greatly, not only in the make-up of the letterpress and illustrations, but especially in finding referees to pass upon the manuscripts submitted. In order to provide for this last the Board of Editors named at the beginning of this report was appointed, but each of our Classes of membership is so inclusive that no one editor for any Class can pass upon many of the manuscripts, even to the extent of recommending competent referees for some of them. Accordingly, the members of the Committee on Publications agreed also to serve

in this editorial capacity and therefore the names of this Committee together with those of the Board of Editors are listed on the inside cover of each number of the TRANSACTIONS and PROCEEDINGS and on the page facing the title page of the completed volumes of these series and of the MEMOIRS. More and more the Society is receiving large monographs and manuscript volumes, often with many expensive illustrations. The difficulty of getting competent referees to pass promptly on these is great and often it is necessary to go outside of the membership of the Society to secure them. In such cases the Committee has been authorized to pay referees who are non-members an honorarium based upon the size of the manuscript and the difficulty of passing judgment upon it.

A problem of policy which is causing much concern is that of giving financial aid to other publications. The Committee early established the general rule that it could not subsidize publications other than our own, but in certain emergency cases this rule was set aside, and now the Committees on Research and Publications have given very considerable sums in support of other publications, as shown in the following list:

To *Biological Abstracts*, \$14,500 (three grants)

*Dictionary of American Biography*, \$10,000 (distributed over two years)

*Dana's System of Mineralogy*, \$6,000 (over three years)

*Journal of the History of Ideas*, \$500

*Mathematical Reviews*, \$3,000

*Annals of Mathematics*, \$1,000

*Isis*, \$1,000

*Swarthmore College Series*, Vol. V. *Benjamin Furley and Quakerism in Rotterdam*, by W. I. Hull, \$1,200

In addition, grants have been made from the Johnson Research Fund to the Academy of Natural Sciences of Philadelphia for the following publications:

*The Fishes of the George Vanderbilt South Pacific Expedition, 1937*, by Henry W. Fowler, \$1,500

*A Pliocene Fauna from Ecuador*, by Henry A. Pilsbry and Axel Olsson, \$500

*The Miocene Invertebrate Fauna of New Jersey*, by Horace G. Richards and Anne Harbison, \$400



Also to the University Museum, University of Pennsylvania, for the publication of the following:

- The Four Canaanite Temples of Beth-shan*, by Alan Rowe, \$2,500  
*Excavations at Homolka*, by V. J. Fewkes, \$1,000  
*Studies of the Sherbro Tribe, Sierra Leone*, by H. U. Hall, \$1,000  
*Ethnology of the Eyak Indians of Alaska*, by Frederica de Laguna, \$1,200  
*Excavations at Khafaje*, by Pierre Delougaz, \$1,000  
*A Sixth Century Monastery at Beth-shan*, by Gerald M. Fitzgerald, \$2,300  
*Catalogue of Etruscan Collections of the University Museum*, by Edith Hall Dohan, \$2,400

A grant of \$1,000 was made in support of the *Annual Tables of Constants and Numerical Data*. In all these cases suitable acknowledgments of these grants have been made in the publications named.

Many other appeals have been and are being made for support or subsidies for publications not our own and the Committee on Publications has usually referred them to the Committee on Research. The question of policy to be followed by the Society in these cases is perplexing and important and is considered in the Report of the Committee on Research.<sup>1</sup>

Fifty-seven manuscripts were accepted for publication during the year as follows:

|                          |              |
|--------------------------|--------------|
| In the PROCEEDINGS ..... | 48 papers    |
| TRANSACTIONS .....       | 6 monographs |
| MEMOIRS .....            | 3 monographs |

Eight manuscripts were considered and declined.

During the year the following contributions were published:

#### TRANSACTIONS:

- Vol. XXVIII. William B. Scott and Glenn L. Jepsen. *The Mammalian Fauna of the White River Oligocene*.  
 Pt. 5. June 1941. *Perissodactyla* by William B. Scott. 234 pp., 22 pls., 21 figs.  
 Vol. XXXI, Pt. 5. August 1941.  
 Harold Heath. *The Anatomy of the Pelecypod Family Arcidae*. 33 pp., 22 pls.  
 Franz Weidenreich. *The Brain and its Rôle in the Phylogenetic Transformation of the Human Skull*. 122 pp., 56 figs.

<sup>1</sup> See p. 79.

- Walton C. Gregory. *Phylogenetic and Cytological Studies in the Ranunculaceae*. 79 pp., 12 pls., 3 figs.
- Vol. XXXII, Pt. 1. November 1941.
- Frank C. Baker, James B. Griffin, Richard G. Morgan, Georg K. Neumann and Jay L. B. Taylor. *Contributions to the Archaeology of the Illinois River Valley*. 209 pp., 68 pls., 4 figs., 1 map.

## PROCEEDINGS:

## Vol. 84, No. 1. April 1941.

- Fred L. Whipple and Cecilia Payne-Gaposchkin. *Theoretical Synthesis of Supernova Spectra*. pp. 1-32. 9 figs.
- George Hornbeck and Irl Howell. *Production of Secondary Electrons by Electrons of Energy Between 0.7 and 2.6 MEV*. pp. 33-51. 4 figs.
- Paul Weiss. *Autonomous Versus Reflexogenous Activity of the Central Nervous System*. pp. 53-64. 8 figs.
- C. B. Davenport. *Responsive Bone*. pp. 65-70. 4 figs.
- Conway Zirkle. *Natural Selection Before the "Origin of Species"* pp. 71-123.

## No. 2. May 1941.

- Commemoration of the Life and Work of Alexander Dallas Bache.*
- Edwin G. Conklin. *Alexander Dallas Bache and His Connection with the American Philosophical Society*. pp. 125-144.
- Henry Butler Allen. *Alexander Dallas Bache and His Connection with The Franklin Institute of the State of Pennsylvania*. pp. 145-149.
- Edward P. Cheyney. *The Connection of Alexander Dallas Bache with the University of Pennsylvania*. pp. 151-160.
- Merle M. Odgers. *Bache as an Educator*. pp. 161-171.
- Rear Admiral Leo Otis Colbert. *Alexander Dallas Bache as Superintendent of United States Coast Survey, 1843-1867*. pp. 173-180.
- Frank B. Jewett. *Alexander Dallas Bache, a Founder, First President and Benefactor of the National Academy of Sciences*. pp. 181-186.
- Symposium on Geomagnetism.*
- O. H. Gish. *Terrestrial Electricity in Relation to Geomagnetism*. pp. 187-204. 9 figs.
- N. H. Heck. *The Magnetic Survey of the United States*. pp. 205-224. 11 figs.
- A. G. McNish. *The Significance of Fossil Magnetism*. pp. 225-237. 8 figs.

- H. E. McComb. Geomagnetic Observatories and Instruments. pp. 239-255. 17 figs.
- H. F. Johnston. Magnetic Work at Sea. pp. 257-262. 3 figs.
- J. A. Fleming. Geomagnetism: World-Wide and Cosmic Aspects with Especial Reference to Early Research in America. pp. 263-298. 19 figs.
- C. W. Gartlein. Aurora and Geomagnetism. pp. 299-307. 5 figs.
- L. V. Berkner. Contributions of Ionospheric Research to Geomagnetism. pp. 309-321. 10 figs.
- H. E. Hallborg. Correlations of Short Wave Radio Transmission Across the Atlantic with Magnetic Conditions. pp. 323-337. 10 figs.
- Paul R. Heyl. Magnetism and Its Uses. pp. 339-351.

No. 3. May 1941.

- Richard Krautheimer. S. Pietro in Vincoli and the Tripartite Transept in the Early Christian Basilica. pp. 353-429. 18 figs.
- Arthur Prudden Coleman. John Bowring and the Poetry of the Slavs. pp. 431-459.

No. 4. June 1941.

Symposium on Recent Advances in Psychology.

- Karl S. Lashley. Coalescence of Neurology and Psychology. pp. 461-470.
- Arnold Gesell. The Genesis of Behavior Form in Fetus and Infant. pp. 471-488. 8 figs.
- Wolfgang Köhler. On the Nature of Associations. pp. 489-502. 2 figs.
- Edward L. Thorndike. Mental Abilities. pp. 503-513. 3 figs.
- Carney Landis. Psychoanalysis and Scientific Method. pp. 515-525.
- Robert M. Yerkes. Psychology and Defense. pp. 527-542.
- Edward C. Tolman. Motivation, Learning and Adjustment. pp. 543-563.

No. 5. July 1941.

- Zdeněk Kopal. Determination of Limb Darkening in Eclipsing Binaries from Color-Index Observations. pp. 565-587.
- S. A. Korff. The Production of Neutrons by the Cosmic Radiation. pp. 589-603. 3 figs.
- Ruth B. Howland. Structure and Development of Centrifuged Eggs and Early Embryos of *Drosophila melanogaster*. pp. 605-616. 1 pl.
- Roberts Rugh. Experimental Studies on the Reproductive Physi-

ology of the Male Spring Peeper, *Hyla crucifer*. pp. 617-632  
3 pls.

Leonardo Olschki. What Columbus Saw on Landing in the West Indies. pp. 633-659.

Thomas F. Anderson and B. M. Duggar. The Effects of Heat and Ultraviolet Light on Certain Physiological Properties of Yeast. pp. 661-688. 6 figs.

Earle R. Caley. The Corroded Bronze of Corinth. pp. 689-761.  
5 pls.

No. 6. August 1941.

Daniel Sutherland Davidson. Aboriginal Australian String Figures. pp. 763-901. 113 figs.

Vol. 85, No. 1. November 1941.

Hugh S. Taylor. Large Molecules Through Atomic Spectacles. pp. 1-12. 11 figs.

John H. Northrop. Crystalline Diphtheria Antitoxin. pp. 13-17.  
1 fig.

G. H. Parker. The Method of Activation of Melanophores and the Limitations of Melanophore Responses in the Catfish, *Ameiurus*. pp. 18-24. 1 pl.

H. S. Jennings. Genetics of *Paramecium bursaria*, II. Self-Differentiation and Self-Fertilization of Clones. pp. 25-48. 3 figs.

Thomas Hume Bissonnette. The "Mule" Pheasant. pp. 49-70. 8 pls.

Tucker Brooke. Some Pre-Armada Propagandist Poetry in England (1585-1586). pp. 71-83.

Campbell Bonner. The Ship of the Soul on a Group of Grave-Stelae from Terenuthis. pp. 84-91. 7 figs.

YEAR BOOK for 1940. 466 pp. April 1941.

The receipts on the sale of publications during 1941 amounted to \$2,287.20. The cost of direct advertising was \$509.30; this consisted of sending announcements of certain publications to libraries, institutions and individuals and inserting several advertisements in suitable historical or scientific journals. In addition to this, copies of almost every publication issued by the Society during the year have been sent to appropriate journals for review.

COST<sup>1</sup> OF PUBLICATIONS DURING 1941

## TRANSACTIONS:

|                                                         |            |
|---------------------------------------------------------|------------|
| Vol. XXVIII, Part 5. 234 pp., 22 pls.,<br>21 figs. .... | \$1,951.57 |
| Vol. XXXI, Part 5. 234 pp., 34 pls., 59<br>figs. ....   | 1,580.57   |
| Vol. XXXII, Part 1. 209 pp., 68 pls., 4<br>figs. ....   | 1,729.97   |

\$ 5,262.11

## PROCEEDINGS:

|                                                      |           |
|------------------------------------------------------|-----------|
| Vol. 84, No. 1. 123 pp., 25 figs. ....               | \$ 707.69 |
| No. 2. 227 pp., 1 pl., 92 figs. .                    | 1,350.63  |
| No. 3. 107 pp., 18 figs. ....                        | 623.59    |
| No. 4. 103 pp., 13 figs. ....                        | 569.40    |
| Second printing from stand-<br>ing type .....        | 156.90    |
| No. 5. 197 pp., 9 pls., 9 figs. .                    | 1,046.31  |
| No. 6. 139 pp., 113 figs. ....                       | 862.61    |
| Vol. 85, No. 1. 91 pp., 9 pls., 22 figs. .           | 803.51    |
| Vol. 82, No. 1. 102 pp. (Second print-<br>ing) ..... | 315.03    |

\$ 6,435.67

YEAR BOOK for 1940. 466 pp. (bound) ..... 2,032.31

CLASSIFIED LIST OF PUBLICATIONS. 173 pp. (Second  
printing from standing type) ..... 195.00Total ..... \$13,925.09

<sup>1</sup> Includes all expenses connected with publication, viz. printing, engraving, wrapping, addressing, mailing, postage, etc., except that of reprints.

## 5. REPORT OF THE COMMITTEE ON RESEARCH

The Laws (Chap. V, Art. 4) specify that the Committee on Research shall consist of the President, *ex officio*, and not fewer than six other members, representative of the four Classes, who shall be nominated by the President and elected by the Council. In practice it has been found desirable to have more than six elected members in order to obtain wider representation of subjects. While regular election to the Committee is for a term of three years, several persons so elected have found it necessary to resign and others have been appointed to fill out their terms. There is no provision in the Laws against the reelection of a person to serve on this Committee. Several members of the Committee have served for two or more terms and their experience has been of great and increasing value. All serve without compensation, their only recompense being for actual expenses incurred in attending meetings. During the year 1941 these expenses for the five meetings of the Committee amounted to \$437.56, while the sum of all the grants for research during the year was \$80,664.53, or more than 180 times the cost of administration. It is a source of satisfaction to know that so large a part of our research funds go into the actual support of research.

The members of the Committee for 1941-42, the subjects they represent and the dates of their last election are listed herewith:

- Albright, William F. (Archaeology), 1939.
- Bronk, Detlev W. (Biophysics and Physiology), 1939.
- Chinard, Gilbert (Languages and History), 1941.
- Conklin, Edwin G., *Chairman* (Biology), 1939.
- Hayes, Carlton J. H. (Modern History), 1941.
- Miller, John A. (Astronomy), 1939.
- Richards, Alfred N. (Physiology and Medicine), 1939.
- Shapley, Harlow (Astronomy), 1939.
- Sinnott, Edmund W. (Botany), 1940.
- Swann, W. F. G. (Physics), 1939.
- Taylor, Hugh S. (Chemistry), 1939.
- Morris, Roland S., *President, ex officio* (Jurisprudence and Administration).

There are three research funds in the keeping of the Society, the Penrose Fund which is unrestricted, the Johnson Fund which is partially restricted in that it has been agreed that persons working in certain institutions may be regarded as occupying a preferred position, and the Daland Fund which is restricted to research in clinical medicine and one institution has, for the time being, been given a preferred position. The Committee has been charged with the distribution of research grants from all three of these funds and the same forms of application and methods of procedure are used in all cases.

The Committee held five meetings during the year 1941, namely, on February 21, April 4, June 6, October 10 and December 12. Applications and supporting letters are manifolded and sent to the members of the Committee about ten days in advance of the meeting; in many cases members consult by correspondence or in person with applicants, or with persons conversant with the applicants or their projects.

Several years ago the Committee decided that apparatus and materials of lasting value that have been purchased from our research funds should be marked with metal tags reading: "Property of the American Philosophical Society, Philadelphia," and should be subject to recall when the project for which they were purchased had been fulfilled. As a matter of fact this has amounted to an indefinite loan, since projects are rarely finished. In the meantime the Committee has been receiving many applications for apparatus and materials similar to that already on loan, and the Committee has voted to request the return of such items after the expiration of the period named in the application as the probable duration of the research, unless there are good reasons why this should not be done. A list of items now on loan with the approximate date given for completion of the research for which they were purchased follows:

| Apparatus                                                                                                  | Period of Loan  |
|------------------------------------------------------------------------------------------------------------|-----------------|
| Concave diffraction grating .....                                                                          | 1937—Indefinite |
| Equipment for aluminizing mirrors in optical train .....                                                   | 1940—Indefinite |
| Regional spectrophotometer, direct vision hand spectroscope,<br>thermostat for rapid reaction device ..... | 1939—1943       |
| High precision graduated circle with accompanying micro-<br>scopes .....                                   | 1939—Indefinite |
| Geiger-Müller Counter, electrometer, ionization chamber .....                                              | 1941—1943       |
| Thermionic DC amplifier, galvanometer .....                                                                | 1940—Indefinite |
| Permanent magnet for construction of beta-ray spectrograph ..                                              | 1938—1940       |

|                                                                                            |                 |
|--------------------------------------------------------------------------------------------|-----------------|
| 10 milligrams radium-beryllium neutron source .....                                        | 1939-1941       |
| Warburg respirometer .....                                                                 | 1940-1942       |
| Densitometer .....                                                                         | 1941—Indefinite |
| Thermograph, hygograph .....                                                               | Returned        |
| Taylor Instrument Co. dermatherm .....                                                     | 1940-1942       |
| Dionic water tester .....                                                                  | 1939—Indefinite |
| Libby photoreflexometer .....                                                              | 1941—Indefinite |
| Colorimeter .....                                                                          | 1938-1939       |
| High angle centrifuge .....                                                                | 1938—Indefinite |
| Micro-manipulator .....                                                                    | 1938-1940       |
| Micro-manipulator .....                                                                    | 1939—Indefinite |
| Zeiss research microscope .....                                                            | 1937-1938       |
| Spencer research microscope .....                                                          | 1939—Indefinite |
| Spencer inclinocular research microscope, Spencer binocular<br>dissecting microscope ..... | 1938-1940       |

The Committee has considered the relative value of small grants to individuals as compared with larger ones to groups of investigators or to institutions. It has been decided that in general grants should not be made to institutions, but rather to individuals or groups of individuals working upon a definite project. However it is usually advisable to make payments through the business offices of the institutions where the work is being done. In many fields co-operation on some large project is most fruitful and the Committee is ready to consider such cooperative projects.

In general the Committee has declined to consider applications for grants in aid of publication and in particular it has in many cases refused to furnish subsidies to commercial publishers for bringing out certain books. This is a wise and necessary policy for the frequent subsidizing of even the most worthy publications would soon exhaust our funds, and the Society would lose much of the credit which comes from its own publications. The Society is now publishing in its own series books as well as monographs and articles and it should continue to support its own publications rather than those of some other organization.<sup>1</sup>

### THE PENROSE FUND

The budget for 1941 assigned \$75,000<sup>2</sup> from the income of the Penrose Fund for the support of research during the calendar year.

<sup>1</sup> See p. 71.

<sup>2</sup> At the meeting of the Council on April 23, 1941, an extra appropriation of \$2,000 was assigned to the Research Fund for the work of the Committee on Education and Participation in Science. This amount was turned over to that Committee the following June. See p. 39.



To this was added a balance of \$9,670.23 carried over from 1940 and refunds and canceled grants amounting to \$3,164.77, so that a total of \$87,835.00 was available for grants during the year. The following 104 grants, 4 of which were authorized in 1940 to be drawn from the 1941 budget, were awarded, totaling \$63,094.53, and leaving a balance of \$24,740.47 to be carried over to the 1942 budget. In addition to the sums granted from the 1941 budget grants amounting to \$5,500 have been approved to be drawn from the 1942 budget and \$3,000 from the 1943 budget.

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| Grant No. 500. Barry Commoner, Queens College, for apparatus to be used for the completion of studies on the relation between respiration and growth in plant cells .....                                                                                                                                                                              | \$ 400 |
| Grant No. 501. Robert F. Pitts, New York University, for equipment for a combined functional and morphological study of the central neural mechanisms initiating and regulating respiration .....                                                                                                                                                      | 670    |
| Grant No. 502. Charles S. Shoup, Vanderbilt University, for apparatus for (1) the investigation of the action of carbon monoxide and CO/O <sub>2</sub> mixtures on respiratory activity in luminous bacteria; and (2) a study of the carbon dioxide carried by natural waters in relation to contained bicarbonate in the presence of pollutants ..... | 100    |
| Grant No. 503. H. S. Jennings, University of California at Los Angeles, for a technical assistant in connection with genetic, behavioristic and cytological studies in "sex types" or "mating types" in Protozoa .....                                                                                                                                 | 1,500  |
| Grant No. 504. Serge A. Korff, Bartol Research Foundation, for technical assistance in cosmic ray investigations in connection with the United States Antarctic Service. (Second grant.) .....                                                                                                                                                         | 400    |
| Grant No. 505. Harold Sprout, Princeton University, for traveling expenses in connection with the study of American Naval policy in its geographical, technological, military, economic and political ramifications .....                                                                                                                              | 250    |
| Grant No. 506. Harold Fisher Wilson, State Teachers College, Glassboro, N. J., for travel and technical assistance in connection with the study of the regional social history of rural southern New Jersey during the nineteenth century. (Second grant.) .....                                                                                       | 200    |
| Grant No. 507. Harry Gregory Albaumb, Brooklyn College, for apparatus for research on the specific rôle of auxin in plant growth; detailed study of the respiratory metabolism .....                                                                                                                                                                   | 300    |
| Grant No. 508. D. H. Kabakjian, University of Pennsylvania, for technical assistance in the study of luminescence in pure crystals. (Second grant.) .....                                                                                                                                                                                              | 300    |
| Grant No. 509. Wilson M. Powell, Kenyon College, for travel, equipment, technical assistance, etc., in connection with the study of protons, mesotrons, and the scattering of penetrating particles in cosmic rays at the summit of Mt. Evans in Colorado (altitude 14,170 feet) with a large Wilson cloud-chamber .....                               | 500    |

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| Grant No. 510. John Francis McDermott, Washington University, for travel while preparing a biography of Auguste Pierre Chouteau (1786-1838), a member of one of the principal pioneer families of St. Louis and an important figure in the fur trade of the Southwest. (Second grant.) .....                                                                                | 200   |
| Grant No. 511. Edward Jay Schremp, Washington University, for technical assistance, field work, transportation of apparatus and travel in connection with the recording of the fine structure pattern of cosmic-ray intensity, and the study of its time variations at stations of different altitude but the same geomagnetic latitude as St. Louis. (Second grant.) ..... | 500   |
| Grant No. 512. Fritz Gustav Anton Kraemer, New York, for the preparation of a reference book on "The Parliaments of Continental Europe from 1815 to 1914" .....                                                                                                                                                                                                             | 650   |
| Grant No. 513. Stuart McGregor Pady, Ottawa University, Kansas, for a technical assistant, field work, etc., in connection with the investigation of the controversial problem of whether there are two species of <i>Melampsorella</i> , the witches' broom rust on <i>Abies</i> (fir) and <i>Picea</i> (spruce) .....                                                     | 600   |
| Grant No. 514. Emil W. Haury, University of Arizona, for technical assistance, field work, travel and supplies for the continuation of studies in an archaeological site on the Ft. Apache Indian Reservation, Arizona. (Third grant.) .....                                                                                                                                | 500   |
| Grant No. 515. Vladimir J. Fewkes, University Museum, University of Pennsylvania, for travel, field work, etc., in connection with the study of primitive pottery making still practised by the American Indians of the Southeastern area .....                                                                                                                             | 500   |
| Grant No. 516. Edgar Anderson, Washington University, for a collaborator and assistant for the preparation of a cytogenetic and taxonomic monograph of <i>Tripsacum</i> in Central and North America. (Second grant.) .....                                                                                                                                                 | 1,200 |
| Grant No. 517. History of Science Society for assistance in financing the publication of the journal, <i>Isis</i> .....                                                                                                                                                                                                                                                     | 1,000 |
| Grant No. 518. Agnes Addison, University of Pennsylvania, for travel, photographs, etc., in connection with the architectural work done by William Strickland in Nashville, Tenn., 1845-1854 .....                                                                                                                                                                          | 200   |
| Grant No. 519. John David Black, Anderson College, for the purchase of maps in connection with the study of the distribution of the fishes of Arkansas .....                                                                                                                                                                                                                | 100   |
| Grant No. 520. John B. Buck, University of Rochester, for travel and living expenses in Jamaica while making studies on the firefly ....                                                                                                                                                                                                                                    | 300   |
| Grant No. 521. Monica Healea, Vassar College, for a technical assistant in studies of the secondary electron emission from metals when they are bombarded with positive ions .....                                                                                                                                                                                          | 750   |
| Grant No. 522. John Ellsworth Merrill, Hunter College, for a computing assistant in the preparation of tables for the calculation of the orbits of eclipsing variables when the star-disks are totally or partially darkened at the limb .....                                                                                                                              | 600   |

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| Grant No. 523. B. Edwin Blaisdell, Massachusetts Institute of Technology, for a computer in the study of the numerical integration of Laplace's differential equation for the equilibrium of a fluid drop of axial symmetry. (Third grant.)                                                                                                                                                                                    | 250              |
| Grant No. 524. Henry N. Andrews, Jr., Washington University, for technical assistance, travel, etc., in connection with the collection, preparation and study of the fossil plants contained in the calcareous petrifications known as "Coal Balls" from the open pit coal mines of southern Illinois, Missouri and Kansas. (Second grant.)                                                                                    | 200              |
| Grant No. 525. W. W. Coblentz, National Bureau of Standards, for transportation and maintenance at field station, in connection with radiometric measurements on the heat emitted by the dark and bright areas of the surface of the planet Mars, during the opposition in October 1941                                                                                                                                        | 500 <sup>1</sup> |
| Grant No. 526. William S. Cooper, University of Minnesota, for airplane photographs in connection with the investigation of the sand dunes of the Pacific coast of North America, their origin and development under the influence of wind, vegetation and other factors.                                                                                                                                                      | 300              |
| Grant No. 527. Oren F. Evans, University of Oklahoma, for travel and field expenses for the determination of the exact method of formation of spits, bars, and off-shore bars                                                                                                                                                                                                                                                  | 100              |
| Grant No. 528. Wolfgang Köhler, Swarthmore College, for a research assistant for the study of experimental schemes to demonstrate and to clarify the nature of the Höfding function in animals                                                                                                                                                                                                                                 | 600              |
| Grant No. 529. Richard M. Field, Princeton University, for photographic paper and other expendable supplies to aid in the continuation of the seismological station at Ivigtut, Greenland                                                                                                                                                                                                                                      | 125              |
| Grant No. 530. F. F. Nord, Fordham University, for technical assistance and equipment in connection with the investigation of hydrogenation catalyst preparations using synthetic polymers with platinum metals                                                                                                                                                                                                                | 1,000            |
| Grant No. 531. John E. Potzger, Butler University, for transporting equipment and labor, in connection with the study of the problem of whether the "sleeve type" peat borers can be relied upon to insure penetration to original lake bottoms in bogs located in sandy regions                                                                                                                                               | 150              |
| Grant No. 532. Lester W. Strock, Saratoga Springs Commission, for technical assistance in the study of the geochemistry of natural mineral waters. (Third grant.)                                                                                                                                                                                                                                                              | 500              |
| Grant No. 533. Herbert L. Eastlick, Washington State College, for materials, photographs, etc., in connection with (a) an attempt to analyze the factors responsible for the failure of transplanted chick limbs to develop functional capacity when grafted to the brachial region of embryonic chick hosts; and (b) further histological studies of the degeneration and atrophy of the musculature of embryonic transplants | 200              |
| Grant No. 534. Dwight Lucian Hopkins, Mundelein College, for equipment for further studies of the adaptation of amoebae to changing                                                                                                                                                                                                                                                                                            |                  |

<sup>1</sup> Grant relinquished.

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| concentration and the regulation of the water content of the protoplasm. (Third grant.)                                                                                                                                                                                                             | 250   |
| Grant No. 535. John A. Moore, Brooklyn College, for equipment for the study of embryonic temperature tolerance and the rate of development in <i>Rana pipiens</i> from different latitudes                                                                                                          | 300   |
| Grant No. 536. Willard Z. Park, University of Oklahoma, for travel and field work while making an anthropological study of the Kagaba Indians in the Sierra Nevada de Santa Marta of Colombia                                                                                                       | 400   |
| Grant No. 537. Estella T. Weeks, Yonkers, N. Y., for travel, photographs, etc., in connection with the study of the hymns and sacred dance tunes of the United Believers, called Shakers                                                                                                            | 150   |
| Grant No. 538. Robert F. Heizer, University of California, for travel, etc., in connection with a laboratory analysis and interpretation of the archaeological collections and notes of Dr. Aleš Hrdlička from Kodiak and the Aleutian Islands <sup>1</sup>                                         | 1,500 |
| Grant No. 539. William F. Jenks, Cerro de Pasco Copper Corp., Peru, for field expenses, transportation, etc., in connection with the study of various geological features of the Andes of central Peru, in the department of Junin                                                                  | 500   |
| Grant No. 540. Harrison F. Flippin, Philadelphia General Hospital, for a technical assistant in connection with pharmacological, toxicological, and therapeutic studies in man of compounds for the control of pneumonia; epidemiological and bacteriological studies on pneumonia. (Second grant.) | 500   |
| Grant No. 541. Otto Benesch, Cambridge, Mass., for the completion of a corpus of Rembrandt's drawings                                                                                                                                                                                               | 500   |
| Grant No. 542. James A. Geary, Catholic University of America, for travel and technical assistance of a Fox Indian in connection with the editing of a text written by a Fox Indian, in the possession of the Bureau of American Ethnology. (Second grant.)                                         | 125   |
| Grant No. 543. Hilda Geiringer, Bryn Mawr College, for assistance in computation in the study of "Analysis of Variance"                                                                                                                                                                             | 400   |
| Grant No. 544. Clyde Kluckhohn, Harvard University, for research assistants and travel in connection with the study of the socialization of forty-eight Navaho Indian children                                                                                                                      | 700   |
| Grant No. 545. Edgar Howard Sturtevant, Yale University, for an assistant in editing and preparing for publication material on Etruscan inscriptions. (Second grant.)                                                                                                                               | 1,000 |
| Grant No. 546. Hans Tietze, Metropolitan Museum of Art, for travel, secretarial help, etc., while preparing a critical catalogue of the Venetian drawings of the fifteenth and sixteenth centuries                                                                                                  | 1,500 |
| Grant No. 547. L. R. Cleveland, Harvard University, for the salary of an artist in connection with the study of chromosomal structure, duplication and aberrations in <i>Holomastigotoides</i> . (Second grant.)                                                                                    | 800   |
| Grant No. 548. Olin E. Nelsen, University of Pennsylvania, for the purchase of opossums to be used for the study of the mating reactions in the opossum induced by hormone injections; the effect of different quantitative amounts of relatively pure hormone factors                              |       |

<sup>1</sup> Project and payment postponed.

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| upon the induction of ovulation in the opossum; and an experimental study of early cleavage of the opossum egg .....                                                                                                                                                                                                                                                                                                           | 100                |
| Grant No. 549. Charles Palache and Harry Berman, Harvard University, for technical assistants for the completion of a new seventh edition of the <i>Dana System of Mineralogy</i> .....                                                                                                                                                                                                                                        | 2,000 <sup>1</sup> |
| Grant No. 550. Friedrich Engel-Janosi, Johns Hopkins University, for travel, etc., while preparing biographies of Hübner, Reebberg and Prokesch von Osten with a view to extending our knowledge of the history of Central Europe in the nineteenth century .....                                                                                                                                                              | 400                |
| Grant No. 551. Walter John Moore, Jr., Catholic University of America, for equipment and supplies for an investigation of the properties of the simpler aliphatic free radicals in the gas phase and in solution .....                                                                                                                                                                                                         | 400                |
| Grant No. 552. Frank H. Johnson, Princeton University, for technical assistance and supplies, for the study of the mechanism of action of sulfonamide compounds on the metabolism of luminous bacteria ..                                                                                                                                                                                                                      | 300                |
| Grant No. 553. Roberts Rugh, New York University, for a technical assistant, animals and equipment for the study of the effect of increased hydrostatic pressure applied at critical periods, on the polar body formation and early cleavage of the frog's egg. (Third grant.) .....                                                                                                                                           | 400                |
| Grant No. 554. Walter Karl Wilbur, University Museum, University of Pennsylvania, for travel, drawing, painting, etc., in connection with the endeavor to identify the objects pictured in the Aztec Codices in order to further the deciphering of the hieroglyphs, and by comparison with the others, to help to solve the questions of age, geographical origin and tribal affiliations of the authors of the Codices ..... | 800                |
| Grant No. 555. Carroll W. Grant, Brooklyn College, for supplies and field work in connection with the study of the interrelationships of zoogloea-forming marine bacteria and other marine phytoplankton in slime and film formation .....                                                                                                                                                                                     | 500                |
| Grant No. 556. D. T. MacDougal and J. Dufrenoy, Carmel, California, for traveling expenses in connection with the study of symbiosis of Monterey pine with fungi. (Second grant.) .....                                                                                                                                                                                                                                        | 300                |
| Grant No. 557. Betty Holmes Huscher and Harold A. Huscher, Colorado Museum of Natural History, for field expenses of an archaeological survey of non-Pueblo remains in unreported areas of Colorado .....                                                                                                                                                                                                                      | 500                |
| Grant No. 558. <i>Annals of Mathematics</i> , in support of the publication .....                                                                                                                                                                                                                                                                                                                                              | 1,000              |
| Grant No. 559. Committee on Urban Research, Princeton University, for the integration of research in various fields directly related to housing, community planning, etc. ....                                                                                                                                                                                                                                                 | 1,000 <sup>2</sup> |
| Grant No. 560. Arthème A. Dutilly, Catholic University of America, for field work, materials, etc., to complete collections of specimens .....                                                                                                                                                                                                                                                                                 |                    |

<sup>1</sup> \$6,000 approved for this project—\$2,000 to be drawn from the budgets of each of the years 1941, 1942, 1943.

<sup>2</sup> \$3,000 approved for this project—\$1,000 to be drawn from the budgets of each of the years 1941, 1942, 1943.

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| for "Arctic Flora," North America; and the preservation by photography of the linguistic material accumulated by the missionaries of the Oblates of Mary Immaculate, in the Yukon Territories, Northern British Columbia, etc. (Second grant.) . . . . .                                                                       | 600                |
| Grant No. 561. Hellmut de Terra, Englewood, N. J., for travel, field expenses, etc., for the completion of a report on "A New Prehistoric Civilization in the Kashmir Valley of India." (Third grant.) . . .                                                                                                                   | 375                |
| Grant No. 562. John N. Couch, University of North Carolina, for a technical assistant for the continuation of studies of the lower fungi (Chytridiales) with particular reference to problems of nutrition and sex . . . . .                                                                                                   | 1,000              |
| Grant No. 563. Paul A. Moody, University of Vermont, for a Libby photoreflexometer for the serological investigation of speciation and evolution in the genus <i>Peromyscus</i> . . . . .                                                                                                                                      | 150                |
| Grant No. 564. Theodore C. Schneirla, New York University, for traveling and field expenses of himself and assistant in Panama to study the army-ant behavior under the suboptimal conditions of the tropical dry season, as a critical test of a theory previously worked out for rainy-season (optimal) conditions . . . . . | 555 <sup>1</sup>   |
| Grant No. 565. Charles R. Dawson, Columbia University, for materials for the construction of a large-scale Tiselius electrophoresis apparatus to be used in solving a fundamental problem in the field of copper-containing proteins, and also for the preparation of enzyme solutions for future research . . . . .           | 300                |
| Grant No. 566. Pennsylvania Historical Association for the preparation of a critical bibliography of Pennsylvania History . . . . .                                                                                                                                                                                            | 1,500              |
| Grant No. 567. B. K. Harned and Hughbert C. Hamilton, Woman's Medical College of Pennsylvania and Temple University, for a technician, feed, chemicals, etc., for the study of the effect of the administration of sodium bromide to pregnant rats on the learning ability of the offspring . . . . .                          | 500                |
| Grant No. 568. Friedrich Walter Lenz, Yale University, for a technical assistant and photostats for the completion of the edition of the discourses of Aelius Aristides and the editing of the scholia on the discourses. (Second grant.) . . . . .                                                                            | 300                |
| Grant No. 569. American Council of Learned Societies, as a contribution toward a supplemental volume of the <i>Dictionary of American Biography</i> . . . . .                                                                                                                                                                  | 2,500 <sup>2</sup> |
| Grant No. 570. Irvin M. Korr, New York University College of Medicine, for a technical assistant in the study of the relation between tissue metabolism and physiological activity. (Second grant.) . .                                                                                                                        | 500                |
| Grant No. 571. Frank Jewett Mather, Jr., Princeton University, for photography in connection with the preparation of a Princeton fascicle of the <i>Corpus Vasorum Antiquorum</i> . . . . .                                                                                                                                    | 250                |
| Grant No. 572. Richard Brandon Morris, College of the City of New                                                                                                                                                                                                                                                              |                    |

<sup>1</sup> Grant relinquished.<sup>2</sup> \$5,000 approved for this project by the Committee on Research—\$2,500 to be drawn from the budgets of each of the years 1941 and 1942; an additional \$5,000 was appropriated by the Committee on Publications.

|                                                                                                                                                                                                                                                                                                                                          |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| York, for travel, photography and secretarial assistance in connection with the study of the history of labor relations in America in the seventeenth and eighteenth centuries .....                                                                                                                                                     | 800   |
| Grant No. 573. Fred A. Barkley, Montana State University, for express charges on shipment of specimens in connection with his monographic studies on the Anacardiaceae of the Western Hemisphere. (Second grant.) .....                                                                                                                  | 150   |
| Grant No. 574. George Wells Beadle, Stanford University, for technical assistance in the investigation of genes controlling known biochemical synthesis in the ascomycete <i>Neurospora</i> .....                                                                                                                                        | 1,200 |
| Grant No. 575. Fay-Cooper Cole, University of Chicago, for an assistant, travel and microfilming in order to study and make available for use manuscript material dealing with the contact period between Indian and White, particularly in Illinois and adjacent territory .....                                                        | 1,500 |
| Grant No. 576. Hetty Goldman, Institute for Advanced Study, for a research assistant in making a catalogue of the coins found during the excavations at Tarsus, 1934-38, and in studying the numismatic history of Tarsus .....                                                                                                          | 500   |
| Grant No. 577. William K. Gregory, American Museum of Natural History, for technical assistance in preparing a bibliography of fishes .....                                                                                                                                                                                              | 800   |
| Grant No. 578. James Alexander Harrison, Temple University, for technical assistance and animals in connection with the study of antigenicity of paramecia .....                                                                                                                                                                         | 900   |
| Grant No. 579. Willem J. Luyten, University of Minnesota, for student assistants in making measurements of the motions of 18,000 stars between declinations — 40 and — 50. (Second grant.) ....                                                                                                                                          | 250   |
| Grant No. 580. Chester Stock, California Institute of Technology, for field work and travel in connection with the study of the occurrence and distribution of Cretaceous reptiles in the Moreno and associated formations of the Coast Ranges of California with particular regard to the presence of dinosaur remains in the Moreno .. | 1,000 |
| Grant No. 581. S. C. Brooks, University of California, for a graduate student assistant in the study of the identity of the nitrogenous bases liberated by <i>Paramecium caudatum</i> , especially as influenced by intake of alkali metal ions. (Third grant.) .....                                                                    | 400   |
| Grant No. 582. Forrest F. Cleveland, Illinois Institute of Technology, for a densitometer to be used for experimental investigations of the Raman spectra of gases and vapors .....                                                                                                                                                      | 650   |
| Grant No. 583. F. Ronald Hayes, Dalhousie University, for two assistants in the study of the inorganic metabolism of developing salmon eggs up to the time the yolk sac is absorbed .....                                                                                                                                                | 500   |
| Grant No. 584. Berta Segall, Museum of Fine Arts, Boston, for travel, photographs, etc., in connection with the study of the history of Greek and Roman jewelry, from the Geometric to the late Imperial periods, based on the evidence from datable tomb groups ...                                                                     | 1,200 |
| Grant No. 585. Robert F. Pitts, New York University, College of Medicine, for apparatus for a functional and anatomical study of                                                                                                                                                                                                         |       |

|                                                                                                                                                                                                                                                                                                                                                                                      |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| the central nervous mechanisms controlling the respiratory and cardiovascular systems. (Second grant.) .....                                                                                                                                                                                                                                                                         | 300   |
| Grant No. 586. Boris Ephrussi, Johns Hopkins University, for an assistant in the quantitative study of gene action .....                                                                                                                                                                                                                                                             | 1,500 |
| Grant No. 587. Marietta Blau, Escuela Superior de Ingenieria, Mexico City, for apparatus and materials for the investigation of the radioactivity of rocks and thermal springs in Mexico; the change in the structure of synthetic Kaolinite, determined by radioactivity methods; research on the silicate formation in $Al_2O_3:SiO_2$ -systems between 900 and 1100 degrees ..... | 500   |
| Grant No. 588. Simon Freed, University of Chicago, for a research assistant for the study of the structures of electrical fields about ions in solutions and related phenomena. (Third grant.) .....                                                                                                                                                                                 | 1,200 |
| Grant No. 589. Franz Boas, Columbia University, for a statistical assistant for the study of the relation between physical and mental development .....                                                                                                                                                                                                                              | 300   |
| Grant No. 590. J. Wendell Burger, Trinity College, Connecticut, for animals, equipment, etc., for the study of the factors of the external environment which modify the sexual cycles of vertebrates (principally the bird) .....                                                                                                                                                    | 500   |
| Grant No. 591. William W. Coblenz, National Bureau of Standards, for materials for the improvement in a photoelectric cell for measuring ultraviolet solar and sky radiation on a horizontal plane ....                                                                                                                                                                              | 500   |
| Grant No. 592. Nelson Goodman, Boston, Mass., for editorial and secretarial assistance in the study of the application of exact logic to philosophical problems .....                                                                                                                                                                                                                | 200   |
| Grant No. 593. Laurence Irving, Swarthmore College, for field work, travel and equipment, in connection with the study of the effect of temperature upon the respiratory exchange of fish. (Fourth grant.) .....                                                                                                                                                                     | 400   |
| Grant No. 594. George N. Kates, Saunderstown, R. I., for travel, stenographic and clerical assistance, in connection with the completion of a study of the Three Lakes of the Imperial City in Peking. ....                                                                                                                                                                          | 600   |
| Grant No. 595. A. Leo Oppenheim, New York, N. Y., for lexicographic research on the culture of the Neo-Babylonian epoch .....                                                                                                                                                                                                                                                        | 1,200 |
| Grant No. 596. John Ernst Weaver, University of Nebraska, for assistants, travel and field work in connection with the completion of the study of the effect of the great drought in the middle west of 1934, 1936 and subsequent years. (Fourth grant.) .....                                                                                                                       | 300   |
| Grant No. 597. Erich A. Marx, Trinity University, Texas, for equipment for the study of the influence of polarization on the decreasing effect of limiting potential .....                                                                                                                                                                                                           | 600   |
| Grant No. 598. Thomas Harper Goodspeed, University of California, for field work in connection with the completion of an analysis of the character and distribution of <i>Nicotiana</i> and related genera in the Andes. (Second grant.) .....                                                                                                                                       | 500   |
| Grant No. 599. E. A. Speiser, University of Pennsylvania, for the research of Dr. Liebesny in completion of the study of Nuzi legal procedure and other problems of cuneiform law in the second millennium B.C. (Second grant.) .....                                                                                                                                                | 600   |



|                |                                                                                                                                                                                                                                                                                   |        |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Grant No. 600. | Philadelphia Bibliographical Center and Union Library Catalogue, University of Pennsylvania, to maintain and improve its service. (Fourth grant.)                                                                                                                                 | 2,000  |
| Grant No. 601. | Edgar Zilsel, New York, N. Y., for living expenses and travel in connection with the study of the rise of scientific methods in the period from the end of the Middle Ages to Galileo                                                                                             | 600    |
| Grant No. 602. | C. T. Elvey, McDonald Observatory, for equipment and travel in connection with the investigation of the light from the night sky                                                                                                                                                  | 550    |
| Grant No. 603. | Wilson M. Powell, Kenyon College, to meet in part the deficit incurred on an expedition in the summer of 1941 for which a grant was previously made, to study the abundance of slow protons and mesotrons with a Wilson cloud-chamber at the summit of Mt. Evans. (Second grant.) | 194.53 |

The distribution of these grants to various subjects is shown in the following table:

|                                         | Grants | Amount      |
|-----------------------------------------|--------|-------------|
| Class I. Mathematics                    | 1      | \$ 400      |
| Astronomy                               | 3      | 1,400       |
| Physics                                 | 11     | 5,144.53    |
| Chemistry and Geochemistry              | 6      | 3,900       |
| Class II. Geology                       | 4      | 2,725       |
| Paleontology                            | 2      | 1,200       |
| Physiography                            | 1      | 300         |
| Zoology                                 | 12     | 4,000       |
| Genetics and Cytology                   | 5      | 6,200       |
| Ecology                                 | 1      | 300         |
| Botany                                  | 9      | 4,000       |
| Bacteriology                            | 1      | 500         |
| Anthropology                            | 4      | 3,900       |
| Psychology                              | 3      | 1,655       |
| Physiology                              | 6      | 2,270       |
| Pathology, Medicine, Immunology         | 2      | 1,400       |
| Class III. History, American and Modern | 3      | 1,950       |
| Government                              | 2      | 1,050       |
| Sociology                               | 3      | 2,000       |
| Class IV. Philosophy                    | 2      | 800         |
| History, Ancient, Medieval and Cultural | 2      | 1,200       |
| Archaeology                             | 5      | 2,375       |
| Ethnology                               | 1      | 700         |
| Philology and Languages                 | 5      | 3,425       |
| Music                                   | 1      | 150         |
| Art                                     | 4      | 3,450       |
| Architecture                            | 1      | 200         |
| Miscellaneous. <i>Isis</i>              | 1      | 1,000       |
| <i>Annals of Mathematics</i>            | 1      | 1,000       |
| <i>Dictionary of American Biography</i> | 1      | 2,500       |
| Union Library Catalogue                 | 1      | 2,000       |
| Total                                   | 104    | \$63,094.53 |

A summary of the research grants from the Penrose Fund made since the beginning of the Society's research program in midsummer of 1933 is shown in the following table:

SUMMARY OF GRANTS AWARDED FROM THE PENROSE FUND  
From July 31, 1933, to December 31, 1941

|                                              | Grants | Amount      | Refunds  | Total       |
|----------------------------------------------|--------|-------------|----------|-------------|
| Class I. Mathematics.....                    | 5      | \$ 4,800.00 |          | \$ 4,800.00 |
| Astronomy and Astrophysics.....              | 30     | 30,300.00   |          | 30,300.00   |
| Meteorology.....                             | 4      | 2,232.00    | \$ 21.75 | 2,210.25    |
| Physics.....                                 | 71     | 75,169.53   | 2,564.66 | 72,604.87   |
| Geophysics.....                              | 3      | 4,200.00    |          | 4,200.00    |
| Chemistry and Geochemistry.....              | 44     | 38,800.00   | 2,264.77 | 36,535.23   |
| Engineering.....                             | 1      | 75.00       |          | 75.00       |
| Total.....                                   | 158    | 155,576.53  | 4,851.18 | 150,725.35  |
| Class II. Geology.....                       | 8      | 4,305.00    |          | 4,305.00    |
| Paleontology.....                            | 15     | 9,825.00    |          | 9,825.00    |
| Geography and Physiography.....              | 3      | 1,200.00    |          | 1,200.00    |
| Zoology.....                                 | 62     | 35,740.75   | 203.73   | 35,537.02   |
| Genetics and Cytology                        | 42     | 36,995.00   | 123.60   | 36,871.40   |
| Ecology, Limnology, and Oceanography..       | 14     | 7,062.50    |          | 7,062.50    |
| Botany.....                                  | 38     | 26,948.00   | 1,227.00 | 25,721.00   |
| Bacteriology.....                            | 5      | 3,050.00    |          | 3,050.00    |
| Anthropology.....                            | 10     | 17,400.00   | 2,146.14 | 15,253.86   |
| Psychology.....                              | 13     | 6,890.00    |          | 6,890.00    |
| Anatomy.....                                 | 13     | 9,425.00    |          | 9,425.00    |
| Physiology.....                              | 57     | 48,485.00   |          | 48,485.00   |
| Biochemistry.....                            | 2      | 900.00      |          | 900.00      |
| Pathology, Medicine, and Immunology...       | 13     | 8,600.00    |          | 8,600.00    |
| Total.....                                   | 295    | 216,826.25  | 3,700.47 | 213,125.78  |
| Class III. History, American and Modern..... | 22     | 13,050.00   |          | 13,050.00   |
| Political Science and Government.....        | 6      | 9,360.00    | 78.31    | 9,281.69    |
| Sociology.....                               | 3      | 2,000.00    |          | 2,000.00    |
| Total.....                                   | 31     | 24,410.00   | 78.31    | 24,331.69   |

SUMMARY OF GRANTS AWARDED FROM THE PENROSE FUND—*Continued*

|                                          | Grants | Amount     | Refunds   | Total      |
|------------------------------------------|--------|------------|-----------|------------|
| Class IV. Philosophy.....                | 2      | 800.00     |           | 800.00     |
| History, Ancient, Medieval, Cultural.... | 13     | 6,825.00   | 100.00    | 6,725.00   |
| Archaeology.....                         | 33     | 40,275.00  | 5,944.53  | 34,330.47  |
| Ethnology.....                           | 13     | 10,150.00  | 500.00    | 9,650.00   |
| Philology and Languages.....             | 23     | 20,125.00  | 42.27     | 20,082.73  |
| Literature.....                          | 13     | 16,650.00  | 750.00    | 15,900.00  |
| Drama.....                               | 2      | 1,000.00   |           | 1,000.00   |
| Music.....                               | 4      | 3,400.00   |           | 3,400.00   |
| Art.....                                 | 5      | 4,200.00   |           | 4,200.00   |
| Architecture.....                        | 3      | 2,700.00   |           | 2,700.00   |
| Total.....                               | 111    | 106,125.00 | 7,336.80  | 98,788.20  |
| MISCELLANEOUS.....                       | 12     | 28,050.00  | 9.45      | 28,040.55  |
| TOTAL.....                               | 607    | 530,987.78 | 15,976.21 | 515,011.57 |

|                                                      |              |              |
|------------------------------------------------------|--------------|--------------|
| Total appropriations July 1933 to December 31, 1941. | \$540,000.00 | \$555,976.21 |
| Refunds and cancelled grants.....                    | 15,976.21    |              |
| Total grants July 1933 to December 31, 1941.....     | 530,987.78   | 531,235.74   |
| Expenses 1933-36*.....                               | 247.96       |              |
| Balance on hand December 31, 1941.....               |              | 24,740.47    |

\* After this date a separate fund was established for research expenses.

## THE JOHNSON FUND

The budget for the year 1941 assigned the sum of \$13,000 for research from the income of the Eldridge Reeves Johnson Fund. To this was added \$3,970, unexpended balance carried over from 1940, making a total of \$16,970 available for grants to be awarded from this Fund during 1941. The following thirteen grants amounting to \$10,490 were approved during the year leaving a balance of \$6,480 to be carried over to 1942:

## Academy of Natural Sciences of Philadelphia

|                                                                                                                                                                                                                                                          |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Grant No. 28. Teng-Chien Yen for living and traveling expenses while making a study of Chinese mollusks in European and American museums of natural history .....                                                                                        | \$1,000 |
| Grant No. 31. Academy of Natural Sciences of Philadelphia for a contribution toward the expenses of publication of a paper by Pilsbry and Olsson describing a Pliocene fauna from Ecuador .....                                                          | 500     |
| Grant No. 32. Henry W. Fowler and Richard A. McLean, for traveling expenses in making a study of fishes and invertebrates of the southern Piedmont and coastal plain, with special reference to the Pedee and Santee River basins of the Carolinas ..... | 360     |
| Grant No. 33. Samuel George Gordon for traveling expenses while making a study of the contact metamorphic minerals of Marble Canyon, Sierra Diablo, in the Trans-Pecos, Texas .....                                                                      | 400     |
| Grant No. 34. Academy of Natural Sciences of Philadelphia for a contribution toward the expense of publication of a monograph on the Miocene invertebrate fauna of New Jersey, by H. G. Richards and Anne Harbison .....                                 | 400     |
| Grant No. 35. Robert G. Chaffee for travel and field work in connection with the investigation of the Oligocene fossil faunas and stratigraphy of the Hat Creek Basin, Wyoming, and adjacent regions .....                                               | 500     |
| Grant No. 36. Robert K. Enders, Swarthmore College, for travel, supplies and field work in connection with the study of the origin and distribution of the mammal fauna of the Caribbean slope of the continental divide in western Panama .....         | 500     |
| Grant No. 38. James A. G. Rehn for travel and field work in making an Orthoptera survey of certain areas of the northwestern United States. (Third grant.) .....                                                                                         | 500     |
| Grant No. 39. R. M. deSchauensee and James Bond for travel in connection with a comprehensive survey of the avifauna of the three Andean ranges of Colombia, with a view to determine the interrelationship of the species and their origin .....        | 450     |

## University Museum, University of Pennsylvania

|                                                                                                                                                                                                              |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Grant No. 29. Samuel Noah Kramer, Oriental Institute of the University of Chicago, for his expenses while copying Sumerian literary tablets and fragments in the University Museum. (Second grant.) .....    | 1,800 |
| Grant No. 30. Helen C. Palmatary for traveling expenses while studying the archaeology of Marajó Island, at the mouth of the Amazon River .....                                                              | 650   |
| Grant No. 37. University Museum, University of Pennsylvania, to cover the cost of printing a catalogue of the Etruscan collections of the University Museum by Edith Hall Dohan .....                        | 2,400 |
| Grant No. 40. H. U. Hall for his expenses while studying the ethnography, mainly the social organization and religio-magical practices, of the Bolom or Sherbro of Sierra Leone in British West Africa ..... | 1,000 |

## THE DALAND FUND

The appropriation from the income of the Judson Daland Foundation for Research in Clinical Medicine at the beginning of the year 1941 was \$7,000 to which was added \$1,000, unexpended balance carried over from 1940, making a total of \$8,000 available to the Committee on Research during 1941. From this sum the following three grants, amounting to \$7,080, were made leaving a balance of \$920 to be carried over to 1942.

|                                                                                                                                                                                                                                                               |         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Grant No. 4. Philadelphia Institute for Medical Research for continued support of the work of the Institute during 1941 .....                                                                                                                                 | \$6,000 |
| Grant No. 5. Isaac Starr, University of Pennsylvania, for a part time assistant to complete a study of the amount of the circulation in (a) coronary heart disease, and (b) soldier's heart or effort syndrome, by means of the ballistocardiograph .....     | 480     |
| Grant No. 6. Valy Menkin, Harvard Medical School, for a technical assistant, apparatus, equipment, travel, etc., in connection with the study of basic mechanisms of cellular injury particularly as manifested in diabetes with superimposed inflammation .. | 600     |

## REPORTS FROM RECIPIENTS OF GRANTS<sup>1</sup>

(ARRANGED ALPHABETICALLY UNDER THE CLASSIFICATION OF SUBJECTS  
REPRESENTED IN THE MEMBERSHIP OF THE SOCIETY)

### CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

#### MATHEMATICS

HILDA GEIRINGER, Bryn Mawr College and Swarthmore College

Grant No. 543 (1941), \$400. Studies on Analysis of Variance Theory.

In a first study on Analysis of Variance Theory the populations  $V_{\mu\nu}(x)$  of the  $m.n$  chance variables  $x_{\mu\nu}$  have been assumed as general probability distributions not, as usually, as Gauss distributions. Under these assumptions the expectations and the variances of different test functions usually considered in this theory have been investigated. Thus tests of significance have been obtained particularly for the so-called Bernoulli Series, Lexis Series and Poisson Series. Some theorems on the distribution of the quotients of these test functions have been deduced. Then follows a rather detailed study of the behaviour of the test functions if the assumption of independence of the populations is omitted. One of the results is, roughly spoken, that positive average correlation within the rows has in many respects an effect similar to that of a so-called Lexis Series of populations (supernormal dispersion); whereas negative average correlation of the populations may be the cause of subnormal dispersion (Poisson-Series).

Next the Analysis of Covariance is treated in a similar way.—A first paper on the subject described above has been sent to the *Annals of Mathematical Statistics*.

GEIRINGER, HILDA, 1942. Observations on Analysis of Variance Theory. *Ann. of Math. Stat.* (In press.)

—— Note on the Probability of Arbitrary Events. (Submitted for publication.)

<sup>1</sup> All grants are from the Penrose Fund unless otherwise specified.

## ASTRONOMY

GERHARD HERZBERG, University of Saskatchewan

Grant No. 139 (1937), \$1,300. Investigation of the solar spectrum in the photographic infra-red, various investigations of molecular spectra.

The work on the band spectra of boron and its compounds which was described in the preceding report has been continued. The spectrum of BCl was analyzed and the structure of this molecule determined. The internuclear distance found is close to the electron diffraction value for the BCl distance in BCl<sub>3</sub>. The molecular constants of BCl have been compared with those of the isoelectronic molecules CS, PN, SiO and AlF and were found to form with these a regular series. The spectrum of the BH molecule was investigated by Mr. A. E. Douglas. Two new electronic states of this molecule were found. A complete analogy to AlH was established.

At a conference on interstellar molecules at the Yerkes Observatory in June 1941 the writer and E. Teller suggested that three hitherto unidentified interstellar lines in the spectrum of distant stars might be due to the CH<sup>+</sup> molecule. Since at the time no laboratory data were available Mr. A. E. Douglas and the writer tried to obtain a CH<sup>+</sup> spectrum in a discharge through helium to which a small amount of benzene vapour was added. We were indeed able to find three new bands, the R(0) lines of which coincide within less than 0.05 Å with the interstellar lines. It could be shown conclusively that the new bands are due to the CH<sup>+</sup> molecule and therefore that CH<sup>+</sup> molecules are present in interstellar space.

With Mr. A. McKay the writer has started new investigations of photographic infra-red spectra of polyatomic molecules. A steel pipe of 5 m. length, which is filled with the gas to be investigated, has been set up and light is passed through it 10 times giving an absorbing path of 50 m. The molecule CHF<sub>3</sub> (fluoroform) is now being investigated in order to determine the CF distance. Three bands have been found in the photographic region. They are now being studied in more detail.

HERZBERG, G., 1938-41. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 232; for 1938: 178; for 1939: 234; for 1940: 189.

— 1941 (with HUSHLEY, W.). Band Spectrum and Structure of the BCl Molecule. Can. Jour. of Res. A 19: 127-137.

— 1941 (with DOUGLAS, A. E.). CH<sup>+</sup> in Interstellar Space and in the Laboratory. Astrophys. Jour. 94: 381.

DOUGLAS, A. E., 1941. New Electronic Transitions of the BH Molecule. Can. Jour. of Res. A 19: 27-31.

PETER VAN DE KAMP, Sproul Observatory, Swarthmore College

Grant No. 441 (1940), \$1,000. Measurements of double stars on photographs taken with the twenty-four inch Sproul refractor, using coarse objective gratings for the compensation of magnitude equation: the derivation of double star orbits with special attention to these measurements. (This work is in charge of Dr. K. Aa. Strand, research associate at the Sproul Observatory, and the report has been prepared by him.)

Even if we take into account the larger size of modern telescopes no material progress has been made in the accuracy of visual observations of double stars with the micrometer since F. G. W. Struve began his work in 1824.

For pairs with separations over two and a half seconds of arc the visual observations can be replaced entirely by the photographic method provided refractors of no less than thirty feet focal length are used. Certain other precautions being taken the photographic method gives in this case a ten times higher accuracy than the visual observations.

It is well known that the visual observations usually show considerable systematic or personal errors. Attempts to reduce these errors from measures on artificial double stars or by the adoption of a standard observer have failed to give a satisfactory answer to this question. In recent years Dr. Strand has obtained valuable information on this point from his orbit computations which are based mainly on the photographic observations. In each case a large material of visual observations was at hand and the investigation showed that the visually observed position angles, when averaged over many observers, are essentially free from systematic errors. Moreover, it was found that the mean result of 100 nights of observations by various observers has a mean error of ".018 (or ".21 for a separation of 5") which corresponds to about one-third the weight of an average photographic plate (m.e. ".010).

The visually observed distances, however, show in most cases considerable systematic errors even though they are the mean results of many observers with different telescopes.

In the case of the two binary systems investigated during the past year, the results were as follows. For Zeta Aquarii the visually observed distances after 1875 indicate a systematic error of +".07 whereas the early observations (1832 to 1875) show no systematic



deviations. For 61 Cygni the early observations are underestimated by ".05 whereas after 1875 they are too large by the same amount. This sudden change in the "mean observer" has been found in two cases previously investigated and may be explained by the fact that a substantial change of observers took place about that time. It was somewhat unexpected that the observations of 61 Cygni and Zeta Aquarii should display systematic errors of the same size for the observations after 1875, as their separations differ by a factor of ten.

In addition to the completion of the orbit determinations of the two double stars mentioned a valuable addition was obtained to the photographic material during the months January–August 1941. A total of 170 plates were measured entailing 88,000 settings at the measuring machine, thus bringing the total number of settings for the year September 1940–August 1941 up to 123,000.

The computations for the study of the orbital motions of Zeta Aquarii and 61 Cygni and a very substantial part of the measurements were carried out under this grant by Miss Virginia Burger and Miss Janet M. DeVilbiss.

A summary of the results for 61 Cygni was presented at the Cleveland meeting of the American Astronomical Society on December 29, 1941. The complete investigation is in preparation for publication in the *Astronomical Journal*.

VAN DE KAMP, PETER, 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 267–268.

STRAND, K. AA., 1941. Summary of Results for Zeta Aquarii. Publ. Astron. Soc. of the Pacific 53: 247.

— 1942. The Double Star 61 Cygni. Sky and Telescope, January.

#### FRITZ ZWICKY, California Institute of Technology

Grant No. 458 (1940), \$500. Observations of faint extended celestial objects at high altitudes.

Investigations on many extended celestial objects such as faint emission and reflection nebulosities and the faint extensions of extragalactic nebulae can successfully be conducted only when observations are made with the effects of the general light from the night sky reduced to a minimum. Locations where northern lights, haze or artificial lights of cities, airplane beacons, etc., interfere are obviously to be avoided. On Palomar Mountain which, in respect

to lights of the kind mentioned, is favorably located, additional care must be taken to avoid the effects of frequent heat lightning over the adjacent desert areas and nights must be chosen when the general illumination from the "permanent aurora," which is variable to the extent of about a factor 2, is as weak as possible. As final refinements color filters may be used and photographs made in selected spectral regions for which the specific celestial objects to be studied exhibit the greatest contrast relative to the light of the night sky. For instance, in the study of the faint extensions of the Andromeda nebula the most advantageous region<sup>1</sup> for photographic work lies in the wave length range  $\lambda 5,000$  to  $\lambda 5,400$ . With all of these precautions taken there remained certain problems which could not be solved on Palomar Mountain and it became desirable to search for yet better locations. In the first place one had to get away from the so-called "white haze" which in the Southern California coastal regions extends to great heights of the order of 20,000 feet. In the second place it is to be expected that the ratio of the light from a specific celestial object to the light from the night sky monotonously increases with altitude. With these considerations in mind it was decided to transport a small telescope to high altitudes in regions free from the white haze and also free from high clouds of fine dust such as are often encountered in the central belt of the North American continent.

From frequent observations of the night sky with the naked eye and with field glasses during the past decade it was found that in the regions along the eastern crest of the High Sierra and around the White Mountains of California often, especially during the autumn and winter months, the nights are very clear and dark. A program was therefore outlined proposing observations at altitudes from 9,000 to 14,000 feet in the regions mentioned. This program, if successful, might later on be supplemented by observations at still greater heights, perhaps in South America on suitable mountains such as Aunconquilha (*ca.* 20,000 feet).

Among the equipment available at the California Institute of Technology, an 8-inch F/1 Schmidt telescope, weighing about 100 kg. and capable of being dismantled easily, is the most suitable for the intended field trips. This instrument with various auxiliary equipment as well as a 4-inch refractor for observations of seeing and a

<sup>1</sup> H. W. Babcock and J. J. Johnson, *A Spectrophotometric Study of the Light of the Night Sky*, *Astrophys. Jour.* 94: 271-275 (1941).

portable darkroom were transported to a location 10,500 feet high near Saddlebag Lake north of Tioga Pass. Photographs of various faint objects were obtained on the nights from September 12 until September 17, 1941, all of which were fairly clear. Unfortunately, because of high humidity and midnight temperatures ranging between 10° F. and 25° F. thin layers of frost formed on the Schmidt correction plate. In addition, during the last nights high winds prevailed and the activity in the night sky steadily increased to culminate on the night of September 18 in the most intense auroral display of the past decade. On the same night the first snow storms set in over the High Sierra. By this most unusual chain of circumstances the very purpose of avoiding as much of the light from the night sky as possible, for which the field trip was undertaken, was defeated and the best photographs obtained are not better than good photographs taken at Palomar. It is therefore hoped that a trip to the top of the White Mountains (14,200 feet) of California, intended for the summer of 1942, will meet with better atmospheric conditions. In order to avoid troubles with frosting of the Schmidt plate as well as the effects of dew on the color filters, it is proposed to heat the telescope slightly and to provide for chemical agents which will keep the inside of the telescope tube dry.

My thanks are due to the Geology Department of the California Institute of Technology for the loan of a station wagon, and to Mr. A. B. Meinel for his assistance on the strenuous trip.

## PHYSICS

VICTOR F. HESS, Fordham University

Grant No. 411 (1940), \$2,000. I. Studies on mesotron disintegration and temperature effect of cosmic radiation. II. Studies on latitude and temperature effect of cosmic rays between New York and Valparaiso.

I. A dual telescope for continuous registration of the intensity of the mesotron component of cosmic radiation, devised and constructed at the Bartol Research Foundation by Dr. W. F. G. Swann in collaboration with V. F. Hess, was installed in the basement laboratory of Fordham University in March 1941. The unit consists of 108 Geiger-Mueller counting tubes in six trays arranged in a vertical counter train; alternate trays are so connected for coincidence counting that in reality there are two independent but interposed telescopes of three trays each, with 22 cm. of lead between the

trays and additional heavy screens for exclusion of side showers. Thus the mesotrons, coming in vertically, are actuating both telescopes and are recorded by photographing the dials of two special recorders automatically every two hours. Reliability of operation is indicated by the constancy, within natural fluctuations, of the count ratio between the upper and lower telescope.

Work with this twin telescope was begun in collaboration with F. A. Benedetto and G. O. Altmann in March 1941 and the apparatus was kept in operation ever since with but a few days interruption due to replacements and overhauling.

The mesotron intensities thus obtained were compiled and reduced for twelve and twenty-four hour periods and these values, after correction for barometer effect, correlated with temperature data at ground and at various levels of the daily atmosphere up to about 16 km., as supplied from sounding balloon flights at Lakehurst, N. J.

In collaboration with F. A. Benedetto it was shown that there is a continually decreasing temperature coefficient as one correlates ground mesotron intensity with temperatures at increasingly higher levels. This indicates that air mass is more fundamental in these investigations and by taking average temperatures by the spatial average method the temperature at the higher levels plays undue influence. With a new method proposed by Hess and Benedetto temperature averages for various fractions of the atmosphere can be taken which are only determined by the mass of air present in each fraction ("mass temperature"). It has been shown that the temperature coefficient is almost constant for all fractions of the daily atmosphere up to four fifths of the total air mass.

This corroborates the view that the so-called temperature effect of cosmic rays is primarily an effect of atmospheric mass distribution variations.

In collaboration with F. A. Benedetto and G. A. Altmann the changes of mesotron intensity with change in the average height of the center of gravity of the atmosphere were studied. From the coefficient of displacement derived therefrom the mean life range and the mean life time of the mesotrons at sea level can be calculated. If we assume that the mean energy of the mesotrons passing through the dual telescope is more than one billion electron-volts the resulting life time is about one microsecond; this is a value smaller than values given by other methods. Further studies on this point are

in progress. It is intended to accumulate results at least for one entire year in order to study also the seasonal changes of mesotron intensity. A short report on the results of the first five months of registrations was given at the annual meeting of the American Physical Society, in Princeton, December 30, 1941.

II. A large Compton model C cosmic ray meter was installed on the upper deck of the S. S. "Santa Ana" (Grace Line) and has been in operation since September 1940. In collaboration with Edward B. Berry, S.J., of Fordham University, and with the aid of the computer G. O. Altmann the data collected aboard ship between New York ( $52^{\circ}$  geomagn. Lat. N.) to Valparaiso ( $22^{\circ} 10'$  geomagn. Lat. S.) were correlated with temperature and latitude. The temperature coefficients obtained were in good agreement with values reported by Compton and Turner, and by Gill on the Pacific. The latitude effect alone amounts to seven per cent. Eleven round trips were completed in December 1941. The data on the first three trips were incomplete and therefore it is necessary to continue the registrations for three more trips. A preliminary report was given at the Princeton Meeting of the American Physical Society, December 30, 1941.

Influence of Aurora and the magnetic disturbance of September 18, 1941, was noticed on all apparatus and was reported in a recent publication.

- HESS, V. F., 1941 (with BENEDETTO, F. A.). Mesotron Variation with Upper Air Temperatures. *Phys. Rev.* 60: 610-611.
- 1941 (with BERRY, EDWARD B.). Cosmic Rays and Magnetic Disturbance of September 18, 1941. *Phys. Rev.* 60: 746.
- 1941 (with ALTMANN, G. O.). Effect of Changes of Height of Air Mass on Mesotron Intensity. (Abstract.) *Amer. Phys. Soc. Bull.* 16: 15.
- 1941 (with BERRY, EDWARD B.). Cosmic Ray Measurements Between New York and Valparaiso. (Abstract.) *Amer. Phys. Soc. Bull.* 16: 15.

D. H. KABAKJIAN, University of Pennsylvania

Grants No. 207 (1938), \$350, and No. 508 (1941), \$300. Luminescence in pure crystals.

Introduction of small amounts of foreign substances into certain crystals for the purpose of imparting to them luminescent properties is a well known phenomenon and has been studied exhaustively.

Such a crystal is supposed to contain a certain number of "active centers" due to the distortions produced in its lattice by the presence of the impurity atoms.

The writer has shown in previous papers that it is possible to produce luminescent crystals without the addition of an impurity, also that the intensity of the luminescence in a chemically pure crystal is a function of the temperature history of the crystal. The previous investigations covered certain crystalline zinc borate compounds and a number of radium and barium compounds.

The investigation is now extended to the alkali halide group. Using alpha rays from a strong polonium source (5-10 millicuries) or beta rays from a radium source (6-10) mg. for the excitation of luminescence, the following crystals have been examined and found to have properties quite similar to Ra and Ba groups—LiCl, LiBr, LiI, NaCl, NaBr, NaI, KCl, KBr, KI.

Preliminary and incomplete results indicate that, (1) it is possible to produce luminescence in these crystals in a state of purity.

(2) That the luminescence may be greatly intensified by a heat treatment, i.e. by simply raising the crystals to higher temperatures and allowing them to cool. When so treated the intensity of luminescence increases as a continuous function of the heat treatment temperatures without any abrupt changes.

(3) There is always a saturation temperature for intensity of luminescence for each crystal and the brightness at this point may be 50-100 times as much as that of the unheated crystal.

(4) The emission bands obtained by means of a quartz spectrograph show quite wide bands extending, in most cases, far into the ultraviolet region. Some crystals show a number of quite distinct bands both in the visible and in the ultraviolet regions.

According to the modern theories a perfect crystal of these compounds should not show any visible luminescence. The distribution of electron energy levels would permit only emissions in the extreme ultraviolet region.

The excitability of visible luminescence in these crystals by the alpha rays of polonium without the addition of an impurity or without any treatment, can be explained only by assuming that in its normal state and at the room temperature a crystal of this type contains a number of distortion centers in its lattice and that the number of such centers may be greatly increased by the simple process of raising it to a higher temperature and then allowing it to cool.

It is hoped that an investigation of the nature of these centers and of the distribution of energy in the emissions of an excited pure crystal will be of value in a study of crystal structure of solids.

KABAKJIAN, D. H., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 250-251.

— 1940. Luminescence in Pure Ra and Ba Compounds. Phys. Rev. 57: 700-705.

SERGE A. KORFF, Bartol Research Foundation of the  
Franklin Institute

(Now at New York University)

Grant No. 504 (1941), \$400. Cosmic ray investigations in connection with the United States Antarctic Service.

This grant was made for the purpose of paying the salary of a computer and other expenses incidental to reducing the observations of the cosmic ray intensity obtained on the United States Antarctic Expedition. Immediately upon the return of the U. S. S. "North Star" to Boston in early May 1941, the cosmic ray records were developed, and arranged for computation. During the latter part of May, Ernest K. Smith of Swarthmore College started on the work of measuring and computing. In this he was associated with Dana K. Bailey, physicist of the United States Antarctic Service. During the subsequent months all the records were measured, corrections applied and the ionization due to cosmic rays calculated. The daily means of cosmic ray intensity and also of pressure and temperature were computed. Bursts in the cosmic ray ionization were classified and recorded. The data was put in form for the computation of pressure coefficients by the method of least squares. The coefficient was computed for several periods. At the present time work is under way on the computation of further pressure and temperature correlations.

Preliminary results indicate that the temperature coefficient calculated from the data obtained on board the U. S. S. "North Star" while returning from Antarctica is in good agreement with that observed by E. T. Clarke on board the same ship during the previous season. On the other hand, this same temperature coefficient does not fit the data observed at West Base. This is thought to be due to the unusual meteorological conditions existing there. At the present time further analysis is under way correlating the cosmic

ray observations with meteorological conditions and with the data from radiosonde observations kindly supplied to us by the United States Weather Bureau observer of West Base.

KORFF, S. A., 1941 (with BAILEY, D. K., and CLARKE, E. T.). Report on Cosmic Ray Results. (Read before Amer. Philos. Soc. Nov. 21, 1941. To be published in Proc. Amer. Philos. Soc.)

WILSON M. POWELL, Kenyon College, Gambier, Ohio

Grant No. 509 (1941), \$500. Cloud-chamber studies of cosmic rays on the summit of Mount Evans, Colorado (altitude, 14,125 feet).

The experimental work was performed inside a house trailer on the summit of Mount Evans from June 21 to September 4, 1941. The trailer served as laboratory and living quarters, and was extremely satisfactory. Over 20,000 photographs were made of a Wilson cloud-chamber which was operated at random with the purpose of obtaining a cross section of cosmic rays at this altitude. The cloud-chamber contained five horizontal lead plates each 1 cm. thick. By studying the photographs it is possible to determine whether a particle traversing the plates is an electron, proton or mesotron. Electrons appear in showers or produce showers on passing through the plates. Protons and mesotrons pass through the plates without producing showers. Protons and mesotrons can be distinguished from each other when they stop in the chamber. If they pass through the chamber without stopping they appear alike.

A detailed study of 200 photographs has been made of the rays occurring between the two upper plates of the chamber; 76 per cent of the rays are electrons and 24 per cent are penetrating particles (i.e. mesotrons or protons). If we assume that the number of electrons is increased by a factor of 10 when the rays traverse the 1 cm. lead plate this gives 24 per cent electrons and 76 per cent penetrating particles outside of the chamber.

In 200 photographs two particles appear to be mesotrons stopping in a plate. At the end of the tracks there are thin tracks which can be interpreted as being the disintegration electron. Three particles appear to be mesotrons but show no disintegration electron. Four protons stop in the chamber.

Thirty showers of two particles produced by non-ionizing radiation appear against 10 showers of two particles produced by electrons. This confirms other observations made in the same manner



by me and is in disagreement with the theory of showers. Only two particles can be identified as energetic electrons out of 565 penetrating particles.

What are believed to be the first photographs of the creation of the mesotron which show the nature of the ray producing the mesotrons were obtained. At least 5 photographs of this process appear in the 20,000 pictures. One of these has been published.

At least two cases of cascade showers initiated by a penetrating particle have been observed for the first time. The 20,000 photographs have been examined once to discover the most salient phenomena and further study promises to yield many interesting things in the near future.

POWELL, WILSON M., 1941. Production of Mesotrons by Ionizing Radiation. *Phys. Rev.* 60: 413-414.

FRANCES G. WICK,† Vassar College

(Report prepared by MABEL S. VINCENT, Vassar College)

Grant No. 368 (1939), \$500. Investigation of the effect of neutrons as source of luminescence excitation and a study of the relation of luminescence to changes in physical state and changes in crystal structure.

Previous investigations by Wick and others have shown that some materials acquire a latent phosphorescence when exposed to X-rays, cathode rays or radiations from radium. This latent phosphorescence (thermoluminescence) may be observed in a dark room by warming the materials any time after exposure. Since many elements during exposure to neutrons release energy similar to that from radium, it is reasonable to expect that these radiations resulting from neutron capture may be used to excite luminescence.

A large variety of luminescent materials were available, many of them from the collection of the late Edward L. Nichols. With the aid of a grant from the American Philosophical Society, work was carried on at Columbia and Cornell Universities through the co-operation of J. R. Dunning and R. F. Bacher.

Using mainly the method of thermoluminescence since it provided direct visual comparisons of luminous intensity, very definite evidence was obtained that neutrons excite luminescence in many materials. The amount of light emission varied with the neutron

† Deceased June 15, 1941.

intensity and the susceptibility to neutrons of the chemical elements in the luminous material.

For example a thermoluminescent material, calcium sulphate, containing manganese, all elements susceptible to slow neutrons, showed greater luminescence with slow than fast neutrons. On the other hand, one composed of thorium oxide with a small amount of terbium showed greater luminescence with fast neutrons, as would be expected from the greater susceptibility of thorium to fast neutrons.

Screening the materials during exposure with boron carbide, which absorbs both the slow neutrons and the alpha-particles which result from the capture, caused a great diminution in intensity of luminescence. Screening with lead 1 cm. thick showed no change in intensity, which indicates that the effect observed was not due to gamma rays in the incident neutron beam.

Interposition of a cadmium screen increased the luminescent effect because cadmium captures the neutrons but does not absorb all of the radiations which result from the capture. Addition of a material very susceptible to slow neutrons such as gadolinium greatly increased the luminescence.

Observations were also made using fluorescent materials placed next to a photographic film, and developing the film in the regular way after exposure. A cadmium tungstate fluorescent screen for example used on both sides of a duplitzed X-ray film showed a strong fluorescence to slow neutrons. This fluorescence was reduced markedly by a boron carbide filter, but not by lead 2 cm. thick. With calcium tungstate the effect of the boron carbide screen was less marked. From a study of more than forty fluorescent compounds it was demonstrated that a material which will show fluorescence when exposed to neutrons must have the following characteristics: (1) it must contain an element highly sensitive to neutrons; (2) it must be composed of materials which absorb the particular radiation emitted as a result of this capture; and (3) it must be sensitive to this radiation and able to convert it into visible or photographic light.

It is well known that many materials which are not fluorescent at ordinary temperatures may become fluorescent at higher or lower temperatures. An ordinary photographic film, for example, becomes brilliantly fluorescent at liquid air temperature, and loses

this fluorescence suddenly as the temperature rises slightly above this temperature. Some of the sulphides, on the other hand, become fluorescent when heated during exposure to the exciting radiation, but stop fluorescence as the heat is withdrawn.

With these and many similar phenomena in mind it seemed possible that this temperature range during which fluorescence appears may coincide with a change of state in the material. This change might be indicated in other ways, such as a sudden great increase in specific heat, a change in crystal structure; a discontinuity in the compressibility curve, index of refraction or other properties.

It was intended to collect data from the literature on physical changes and on fluorescence observed over a wide range of temperature, and see if in any cases these points coincided. If this were true, it might indicate some new materials to be examined for fluorescence at points of inflection on the temperature curve.

The amount of information in the literature on both fluorescence or physical changes over a wide range of temperature was found to be surprisingly small. However the material available has been collected in a bibliography—and suggests the need and possible fruitfulness of more research in this area.

WICK, FRANCES G., 1940 (with VINCENT, MABEL S.). Luminescence Excited by Exposure to Neutrons. *Phys. Rev.* 58, No. 6: 578.

## CHEMISTRY

ARTHUR C. COPE, Bryn Mawr College

Grant No. 401 (1940), \$1,000. A study of the rearrangement of allyl groups in three-carbon systems.

The rearrangement of allyl groups in acyclic or alicyclic three carbon systems has been determined to be a general reaction when the alpha carbon atom is attached to two nitrile or carbethoxyl groups, or to one of each of these groups. This conclusion was reached by preparing cyanoacetic esters, malonic esters and malononitriles (ten such compounds in all) each disubstituted by a substituted vinyl and an allyl group, rearranging the compounds by heating to an appropriate temperature, and determining the structure of the rearrangement products. The rate of each of the isomerizations has been determined by following the change in refractive index of the compounds with time at convenient temperatures.

The reactions follow first order kinetics, indicating a unimolecular mechanism.

The rearrangement has been found to proceed with inversion of the (substituted) allyl group in two cases by studying the rearrangement of similar compounds substituted by crotyl rather than allyl groups. The intramolecular character of the rearrangement has been confirmed by rearranging two pairs of compounds which rearranged at similar rates and contained unlike migrating groups. In both cases there was no interchange of groups between the two structures rearranging simultaneously.

Complete results are described in the following joint publications:

- COPE, ARTHUR C., 1941 (with HOYLE, KATHRYN E., and HEYL, DOROTHEA). The Rearrangement of Allyl Groups in Three-Carbon Systems. I. Jour. Amer. Chem. Soc. 63: 1843-1852.
- 1941 (with HOFMANN, CORRIS M., and HARDY, ELIZABETH M.). The Rearrangement of Allyl Groups in Three-Carbon Systems. II. Jour. Amer. Chem. Soc. 63: 1852-1857.

HERBERT FREUNDLICH,† University of Minnesota

(Report prepared by KARL SOLLNER, University of Minnesota)

Grant No. 480 (1940), \$1,200.<sup>1</sup> The adsorption of strong electrolytes on charcoal with special reference to the Hofmeister series and the conceptions of K. H. Meyer.

The first problem begun by Professor Freundlich under the grant of the American Philosophical Society was the adsorbability on solid surfaces of benzenesulfonic acid, tolunesulfonic acid, ethylbenzenesulfonic acid and their salts.

These substances are on the one hand strong electrolytes, on the other hand strongly adsorbable organic compounds. They were previously investigated for their "hydrotropic" behavior by Neuberger<sup>2</sup> and by Freundlich and Slottman.<sup>3</sup> The efficiency as coagulating agents and the lowering of the surface tension of aqueous solutions, brought about by the three mentioned substances, were

† Deceased March 30, 1941.

<sup>1</sup> \$798.33 unexpended.

<sup>2</sup> Biochem. Zeitschr. 76: 107 (1916).

<sup>3</sup> Ibid. 188: 101 (1927).

the subject of a paper by Freundlich and Slottman.<sup>1</sup> In all these cases Traube's rule seems to hold true.

The question to be investigated was whether or not Traube's rule would also hold for the adsorption on solid surfaces and how far adsorbents of different nature (carbon, iron oxide, etc.) may or may not behave analogously.

Several experimental difficulties were encountered in attacking this problem experimentally. It was found that the commercially available adsorbents are not sufficiently free from impurities to be useful. Therefore, ashfree charcoal was prepared, and attempts were made to develop some other suitable adsorbents. With pure sugar charcoal (the only case more fully studied) the adsorption was extremely slow, probably owing to structural peculiarities of the charcoal. Moreover, peptization of the adsorbents was very pronounced, making the analytical procedures more time consuming and less accurate.

The results obtained at the time of Professor Freundlich's death definitely indicate an increasing adsorption with increasing molecular weight, as postulated by Traube's rule.

However, the available data are not sufficient in number and accuracy to deduce from them quantitative relationships. Considerably more work would be required before the data could be collected that are necessary for a satisfactory publication.

F. F. NORD, Fordham University

Grant No. 530 (1941), \$1,000. Investigation of hydrogenation catalyst preparations.

It was deemed necessary to attack the question of the necessity or the dispensability of oxygen in the course of catalytic hydrogenation by means of platinum metals, by methods which can be considered as amplifying each other. In collaboration with Dr. Louis D. Rampino, the first approach consisted in applying an analytical method which guaranteed the purity of the hydrogen or nitrogen introduced into the system. The infinitesimal traces of oxygen present seemed to indicate that the old contention concerning the necessity of oxygen in catalytic hydrogenations is (a) invalid and (b) independent of the nature of the acceptor.

<sup>1</sup> Zeitschr. phys. Chem. 129: 305 (1927).

The possibility of performing hydrogenations by means of the hydrogen resulting from the interaction of carbon monoxide and water, furnished us with the second instrument of approach. The use of carbon monoxide compelled us, as long as we were determined to apply protected catalysts, to make a search for compounds which possibly might enable us (a) to produce highly efficient catalysts and (b) to exclude its poisoning effect upon the metals themselves. Compounds in the group of synthetic high polymers show a manifold superiority as compared with gum arabic, gum tragacanth, etc. Since they fall into two constitutionally different classes we were able accordingly to carry out hydrogenations in water solutions and in organic solvents. It was noticeable that the degree of polymerization as well as the concentration of the polymeric compound possessed a definite effect on the rate of hydrogen transfer to the acceptor. This could also be proven by applying and comparing unfrozen and frozen polymer solutions.

The third coordinate approach to the solution of our problem consisted in applying mixed catalysts with special properties. The avidity of divalent vanadium for oxygen is known, as is its high potency, as a reducing agent. We succeeded in preparing colloidal catalytic systems consisting of Pt and Pd with synthetic high polymers both in the absence and presence of divalent vanadium. The Pd- and Pt-vanadium catalysts served a two fold purpose: (a) to insure the complete removal of oxygen from the system and (b) to produce catalysts whose efficiencies were much greater than that obtained with the noble metal alone, as was especially shown with quinone and benzaldehyde as acceptors.

The application of carbon monoxide for hydrogenation by means of new catalysts together with the aid of an exact analytical method and the use of divalent vanadium represent a practically complete proof for the dispensability of oxygen in catalytic hydrogenations with noble metals.

In collaboration with Mr. Kevin Kavanagh it was observed that, contrary to gum arabic or gum tragacanth, polyvinyl alcohol itself is capable of reducing solutions of  $\text{PdCl}_2$  to colloidal palladium in the absence of hydrogen. This fact tends to throw light on the reasons for the high efficiency of Pd-high polymer catalysts, inasmuch as, due to the much slower rate of reduction effected through the high polymer, compared to the reduction rate observed by using hydrogen, palladium particles of smaller size were produced. This ap-

pears to be supported by measurements according to which the amounts of hydrogen absorbed by PVA-PdCl<sub>2</sub> solutions varied with the concentration of PVA. In addition, it was found that with PVAcetate a palladium catalyst was obtained which in the case of certain acceptors proved to be superior even to PVA-Pd catalysts.

NORD, F. F., 1941 (with RAMPINO, LOUIS D.). Preparation of Palladium and Platinum Synthetic High Polymer Catalysts and the Relationship Between Particle Size and Rate of Hydrogenation. *Jour. Amer. Chem. Soc.* 63: 2745-2749.

— 1941 (with RAMPINO, LOUIS D.). Applicability of Palladium synthetic High Polymer Catalysts. *Jour. Amer. Chem. Soc.* 63: 3268.

## CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

### GEOLOGY AND PALEONTOLOGY

#### ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

Grant No. 34—Johnson Fund (1941), \$400. Publication of a monograph on the Miocene invertebrate fauna of New Jersey, by H. G. Richards and Anne Harbison.

The manuscript of this report is now in the hands of the Publication Committee of the Academy of Natural Sciences and it will probably be published early in 1942.

The study was part of a cooperative arrangement between the Academy of Natural Sciences of Philadelphia and the New Jersey Geological Survey and State Museum. Publication and parts of the field work were aided by a grant from the Johnson Fund of the American Philosophical Society. The fauna of the Kirkwood formation of New Jersey, of Miocene age, has been studied and analyzed. A total of 160 species are recorded—2 species of corals, 1 bryozoon, 1 brachiopod, 1 echinoderm, 3 barnacles and 152 mollusks. Of these 4 are new, and 35 additional are known from only the Kirkwood of New Jersey. A study of this fauna, both from surface outcrops and from numerous wells, shows that the Kirkwood formation is composed of several phases. It is correlated with the Chesapeake Group of Maryland, and contains elements of both the Calvert and St. Mary's formations.

HENRY NATHANIEL ANDREWS, JR., Washington University, St. Louis  
Grant No. 524 (1941), \$200. Contributions to our knowledge of American carboniferous floras.

During the past year some few hundreds of coal-ball specimens have been collected from the Pyramid Mine (No. 6 coal) of the Binkley Coal Company, Perry County, Illinois. The contained fossil plants are often remarkably well preserved and, although it will be some few years before our study of the flora approaches completion, significant contributions have already resulted.

The most abundant element is a species of *Lepidodendron*. The large number of specimens at hand, representing a wide range of branch orders, is making possible an accurate restoration of this prominent member of the Illinois Carboniferous flora. The stems apparently represent a new species, characterized chiefly by the presence of distinctive sclerotic nests in the cortex. A study is also being made of the stem compressions found in the roof shales overlying coal No. 6 in an attempt to correlate these with the remains found in the petrifications. Collections of these compressions have been made from the Old Ben No. 11 mine in Franklin County.

Associated with the stems are leaves, roots, microsporangiate cones and *Lepidocarpon* seeds. One specimen of the latter has been found bearing a gametophyte with well defined archegonia. Two large, more or less complete, microsporangiate cones of the *Lepidostrobus* type have been found in which certain of the sporangia still retain their spores. Microspores of the same size and sculpturing are present within the *Lepidocarpon* seeds. The microspores, moreover, tend to remain together in tetrads after maturation and these tetrads are not uncommon in the seeds. There is no reason to doubt that the microsporangiate cones and *Lepidocarpon* seeds belong to the same species. Microspores have never been reported before this in these seeds nor has there been presented any definite evidence concerning the nature of their microsporangiate organs. A contribution dealing with these fructifications, written in collaboration with Miss Eloise Pannell, is in press.

A second contribution, also in press, deals with a *Coenopterid* fern described under a new generic name. It is apparently related to the *Zygopteris-Botrychioxylon* group, possesses a mixed primary xylem, and a weak development of secondary wood. The most distinctive feature lies in the presence of sclerotic nests scat-



tered through the cortex, a feature which sets it apart from any other genus of living or fossil ferns.

Stems referable to *Mesoxylon* are also abundant in our collections and it has been possible to demonstrate organic connection of these stems with roots of the *Amyelon* type. The latter have long been considered as belonging to stems of Cordaitan affinities but no actual proof has ever been presented before this.

Further studies of the Pyramid Mine coal-balls are in progress. Judging from the fact that almost every collection made thus far has revealed new or otherwise noteworthy fossils it is almost certain that this mine as well as many others in the region, which are as yet virtually unexplored paleobotanically, will continue to yield fossil plants of considerable significance for many years.

ROBERT G. CHAFFEE, Academy of Natural Sciences of Philadelphia

Grant No. 35—Johnson Fund (1941), \$500. Investigation of the Oligocene fossil faunas and stratigraphy of the Hat Creek Basin, Wyoming, and adjacent regions.

The 1941 Vertebrate Paleontological Field Party of the Academy of Natural Sciences, which was made possible in part by a grant from the American Philosophical Society, spent the field season, June 20–August 30, working in the White River beds of the Indian Creek drainage, Hat Creek Basin, Wyoming. There were six in the party as follows: Miss Sally Emlen of Philadelphia, a freshman at Smith College; Jon Dixon of Rochester, New Hampshire, a junior at the University of New Hampshire; John Boomer of Fairmont, West Virginia, a sophomore at the University of Pennsylvania; Edwin Davis of Omaha, Nebraska, a sophomore at Swarthmore College; and Mr. and Mrs. Robert G. Chaffee of the Academy staff.

Important new information and a valuable collection of vertebrate fossils from the middle Tertiary, White River, Oligocene, were secured in that part of the Hat Creek Basin. The absence from this area of the Upper Brulé, or *Leptauchenia* beds, of the Big Badlands as a distinct unit was established. The stratigraphic column worked out shows that the sedimentation of this area during White River time was intermediate in character between that of the Big Badlands and the North Platte Valley. Sedimentary samples for heavy mineral work were collected, and it is hoped that laboratory work on

them will give us a more definite idea of the composition and origin of these intermediate beds.

The palcontological collections made during the season consist of some thirty land mollusks and about two hundred vertebrates belonging to between twenty-five and thirty species (the exact number cannot be determined until the fossils have been fully prepared). This collection will enable us to compare the Oligocene fauna of the Big Badlands of South Dakota with that of the Wyoming area. The outstanding specimens that have been prepared or identified to date are a series of mammal tracks (never before reported from the Oligocene) including rhinoceros, giant pig and possibly camel, a series of Titanotheres dentitions from a single quarry, including a calf lower jaw, upper and lower dentitions of yearlings, and two adult skulls and jaws; upper and lower dentitions of an artiodactyl, *Stibaris* (only one skull is known of this genus); a jaw of a rare marsupial which previously has been reported only from Colorado and the upper and lower dentition of a new edentate.

The generous grant provided by the American Philosophical Society not only made this expedition possible but enabled the Academy to accept as members of the Field Party several volunteer assistants whose activities added to the scientific results of the Field Work. The Academy is therefore doubly grateful to the American Philosophical Society for its cooperation and assistance.

RICHARD M. FIELD, Chairman, Commission on Continental and Oceanic Structure, International Union of Geodesy and Geophysics

Grant No. 529 (1941), \$125. To assist in continuing seismological station at Ivigtut, Greenland.

The grant of one hundred twenty-five (\$125.00) dollars, plus a supplementary gift from Captain N. H. Heck, has been used to provide one year's supplies of photographic paper and chemicals for the Galitzen seismographs at Scoresbysund, Greenland. These materials have been shipped to Greenland at the suggestion, and with the advice, of Captain N. H. Heck, President of the Seismological Association, International Union of Geodesy and Geophysics. The supplies were shipped at different times. No information has been received as yet (November 12, 1941) as to the arrival of the above-mentioned supplies at Scoresbysund; but, whatever the outcome,

according to the agreement made with the Scoresbysund Station, their seismic records for 1939 have already been sent to the United States Coast and Geodetic Survey. If the supplies arrive safely, we eventually are promised the seismic records for 1940 and 1941.

Not only the Greenland geophysicists, but also the International Association of Seismology and the International "Commission" deeply appreciate the cooperation of the American Philosophical Society in the continuance of this essential work in geophysics during this "geo-war."

SAMUEL GEORGE GORDON, Academy of Natural Sciences of  
Philadelphia

Grant No. 33—Johnson Fund (1941), \$400. Study of the contact metamorphic minerals of Marble Canyon, Sierra Diablo, in the Trans-Pecos, Texas.

Marble Canyon in the Sierra Diablo, thirty miles north of Van Horn in the Trans-Pecos, Texas, is so called because of the highly metamorphosed Permian limestone occurring there. This metamorphism is due to a basic igneous plug intrusive in the limestone. The result of the high temperature, pressure and the infiltration of magmatic solutions had been the development of complex silicates.

With Van Horn as a base, it was an hour's drive along the Carlsbad Road to a point opposite the mouth of the canyon and another hour's walk to canyon. It was necessary to carry all water and food. A section of the contact between the piles of intrusive rock and the metamorphosed rock was examined daily, until the whole cul-de-sac-like canyon was circumscribed.

Preliminary examination of the contact minerals shows that magnesian silicates and periclase were developed in the limestones, the latter later altered to serpentine. There was also a later development of some natrolite in the basic rock. In the siliceous limestones much garnet and epidote was formed.

A collection was also made of the contact minerals formed about the rhyolite volcanic plug near the entrance to the canyon—these seem to be high temperature silicates.

The total collection amounts to 250 specimens, and these are being sectioned. For this purpose a diamond saw has been built to cut exceedingly thin localized slices of the rocks to permit their in-

vestigation under the petrographic microscope. A report on the laboratory results will be submitted on the conclusion of this study.

WILLIAM F. JENKS, Cerro de Pasco Copper Corporation, Peru

Grant No. 539 (1941), \$500. Mesozoic stratigraphy of the central Peruvian uplands.

The need for detailed studies of the Mesozoic formations of central Peru has been felt for some time, especially since recent stratigraphic work by Boit has strongly conflicted with ideas earlier presented by McLaughlin. To gain a more precise understanding of the local and regional stratigraphy, especially of Triassic and Jurassic limestones, a period of three months, May to July 1941, was devoted entirely to this problem. Detailed field work was done in the region between Goyllarisquisga and Junin; reconnaissance observations were made as far away as Ambo to the north and Oroya to the south. Many stratigraphic sections, not only of the Triassic and Jurassic limestones but also of Cretaceous and Tertiary formations, were measured.

Fossils were collected in abundance from numerous strata throughout the Triassic and Jurassic limestones, especially in the region between Cerro de Pasco and Carhuamayo. The collection is being studied by Dr. O. H. Haas and Dr. H. E. Vokes at the American Museum of Natural History.

To work out correctly the stratigraphy it was found necessary to make a geological map, on a scale of 1:20,000, of areas in the vicinity of Cerro de Pasco which are of importance to an understanding of the stratigraphy. Two hundred square kilometers, in addition to areas already mapped by geologists of the Cerro de Pasco Copper Corporation, were thus mapped.

As a result of the above work much valuable information, both stratigraphic and structural, has been compiled. Definite statement of conclusions of any kind must necessarily be delayed until after completion of the paleontologic work. With the latter data at hand it is intended to correct any stratigraphic errors which may have been made in the course of field work and to gather at intervals important supplementary stratigraphic information.

## ANATOMY AND ZOOLOGY

RUDOLF ALTSCHUL, University of Saskatchewan

Grant No. 469 (1940), \$300. (a) Distribution of lipofuscin in the human brain, especially in the basal ganglia. (b) Distribution and topography of the tortuous vessels in the brain, their individual variations and possible connection with brain diseases, especially with bleeding and softening.

## (a) Lipofuscin Distribution in the Basal Ganglia

The content of lipofuscin in nerve cells varies with the type of cell and with the age of the individual. It varies also phylogenetically, as far as the central nervous system is concerned, and its content is greater in nerve cells of the higher mammals, especially man.

The increase of this pigment during life has been considered by some as evidence that it is a waste product, which is incompletely eliminated by the aging cells. With equal justification others assert that it is used in intracellular metabolism and as a result of decrease in cellular activity it is not used up completely and therefore accumulated in the cell. The variable distribution of lipofuscin in the different types of nerve cells—of which some are highly pigmented, some less so while others are completely free of pigment, e.g. the Purkinje cells—makes a general application of the wear-and-tear theory of lipofuscin formation rather difficult. Another fact, the presence of lipofuscin in some nerve cell types of newly born children, is also inconsistent with the assumption that this pigment is a waste product. Finally it should be kept in mind that not only does lipofuscin vary in its appearance in different types of nerve cells, in some being in the form of fine granules, in others coarse while in still others it forms small platelets, but its distribution and position in the cell also vary depending on the cell type.

I tried in 1938<sup>1</sup> to determine some correlation between the different cell types of the medulla, pons and mesencephalon, based on their lipofuscin content and its appearance and distribution in the cells.

In the present study the nerve cells of the basal ganglia were examined from this point of view. Special attention was paid to the great motor elements of the pallidum. Their apparent content

<sup>1</sup> Altschul, Rudolf. 1938. Ueber das sogenannte "Alterspigment" der Nervenzellen. *Virchow's Archiv. f. Pathologische Anatomie* 301: 273-286.

in lipofuscin varies with the method of staining. Stained with scarlet red or sudan III, they show a large amount of evenly distributed fat granules in their cytoplasm. Treated with silver nitrate, en bloc (Levaditi's method) or in frozen sections (author's method), the lipofuscin content in most of the cells seems to be very low. Stained with the gentian violet method of Volkmann, two types of granules are often seen, some pale purple, others, fewer in number, being dark in colour. These facts, I believe, indicate that in the large multipolar cells of the pallidum, the lipofuscin shows often a rich fatty component while the pigment and propigment component is scanty, being accumulated in one spot, usually near the nucleus, but sometimes situated near a dendrite, in which it can be seen to extend for a short distance.

On the other hand in the small cells of the putamen and caudate nucleus and in the larger cells of the amygdaloid nucleus the pigment component of lipofuscin is much richer.

In view of the role of the pallidum in neuropathology these findings may be of interest, especially if viewed in connection with the vulnerability of this formation.

#### (b) The Convolted Vessels of the Human Brain

It has long been recognized that sections of the human cerebrum will occasionally show small arterioles which for a short portion of their course are twisted and curved on themselves to form loops and intricate convolutions. These convolutions are found in the zone between the cortical gray matter and the central white matter. Their presence has been variously explained—the earliest suggestion being that they are the result of senile shrinkage of the surrounding nerve tissue.

Later they were considered by Pfeifer to be a device for the regulation of blood pressure, comparable to throttle valves. In 1939<sup>1</sup> I expressed the belief that these convoluted vessels cannot be regarded as a regular mechanism of such importance (1) because of their scarcity and (2) because their presence in the region between the cerebral cortex and the white substance is beyond the most important ramifications in the cortex and therefore would be ineffective for this purpose. At the same time I suggested that these convoluted vessels can only be explained as developmental anomalies and might be of etiological significance in disease.

<sup>1</sup> Altschul, Rudolf. 1939. Zur Angioarchitektonik des Gehirns. *Anat. Anz.* 88: 23-34.

In the course of a further study of their structures, which is still in progress, it seemed opportune to investigate also the presence and appearance of these convoluted bodies in various pathological states.

In carrying out this investigation I have examined the brains of four cases referred to me as genuine epilepsy and have found in every case that these convolutions of the arterioles were located not only in their usual site in the boundary zone between the gray and white matter (most of them in the frontal and parietal lobe) but actually within the substance of the gray matter itself. In addition, in three of the four cases the number of vessels showing this anomaly was increased, very greatly in two of them. As far as I am aware these findings have not previously been noted.

Since the number of my cases is at present too small, I am not in a position to assert that the presence of convoluted segments of cerebral vessels in the frontal and parietal cortex or their increase in number is the cause of epileptic fits. Even if I had studied a much greater volume of material and had obtained identical results throughout, I would not be in a position to postulate any direct correlation with this disease, because the increase in number and the unusual position of these vascular anomalies could still be a concurrent feature—without etiological significance—in a brain otherwise defective in its development.

THOMAS HUME BISSENETTE, Trinity College, Hartford, Connecticut  
Grant No. 384 (1939), \$500. Photoperiodicity in animals.

While studying sexual photoperiodicity in pheasants a mature cock was obtained with partial doubling of both wings such that the bird seemed to have epaulettes on his shoulders. The anomaly resulted from a forking of the radius about one-third of its length from its distal end. One limb of the fork participated in the basic wing while the other extended anteriorly and supported an accessory wrist with one digit of two or more phalanges. This developed primary flight feathers and coverts. Except for this preaxial outgrowth each fundamental wing was apparently normal. It supplied muscle slips to the accessory wing, nerve supply to which was not found. The bird was used with thirty other cocks in a breeding pen with three hundred hens. This abnormality did not appear in any of the first generation chicks from this pen. It is not likely caused by an injury, for both wings are similarly involved.

One Ring-neck "mule" pheasant in the breeding season exemplified the earliest, another the most advanced stage of change from female to male sexuality and plumage. Both, like hen-pheasants generally, had bilaterally well-developed vasa deferentia and epididymides. One had many seminiferous tubules in both right and left "ovaries," not open to the epididymides, varying from infantile or quiescent stages to those undergoing spermatogenesis to spermatids only, and probably recovering from degeneration due to back pressure. Two oviducts (the right, smaller) were in a condition indicating male, without female, sex-hormone activation, like that found in ovariectomized fowl or in castrate Night Herons injected with testosterone propionate.

The other "mule" had but one "ovary" with many cyst-like cavities, suggesting that oogonia and small follicles had undergone lipoidal degeneration and subsequent leaching out by reagents, and a few testicular tubules apparently too infantile to respond to gonadotropic hormones as those of the other "mule" had done. Its single (left) oviduct, merely a groove anteriorly and infantile posteriorly, showed no signs of hormonal activation. These "mules" appear to exemplify in pheasants phases of female intersexuality (Goldschmidt) from crossing species stronger or weaker in sex-differentiating factors in which female-differentiating factors fail in embryonic, juvenile, or early adult life, with early or later development of male plumage and secondary sexual apparatus. The unstable equilibrium may be due to wideness of cross, as in gonadless intersexual hybrid doves (Riddle). In one, somatic non-disjunction may condition dorsal and ventral distribution of female and male feathers, respectively. The intersexual gonads of these "mules" are responsive to seasonal cyclic gonadotropic stimulation and become active in the breeding season when not too infantile to respond.

It is hoped that other "mule" pheasants will be obtained so that they may be tested for sexual photoperiodicity or response to additional lighting in autumn and winter now that their normal seasonal response is known.

Despite the experiments of Bissonnette<sup>1</sup> and Riley,<sup>2</sup> authors such as Rowan<sup>3</sup> and many ornithologists do not believe that light, as

<sup>1</sup> Bissonnette, T. H. J. Exp. Zool. 58: 281-319. 1931.

<sup>2</sup> Riley, G. M. Wilson Bull. 52: 73-86. 1940.

<sup>3</sup> Rowan, Wm. Proc. Zool. Soc. London, Series A 108: 51-77. 1938.



light, acts as the primary stimulus to avian sexual activation. They believe that light merely keeps birds awake and exercised. It is this wakefulness and exercise that they consider to be the primary stimulus. The following experiments treat this problem.

After a number of trial experiments with a thermally controlled circuit interrupter, a circuit interrupter driven by a synchronous motor was devised. Flashing light derived from this apparatus was administered to sexually inactive male starlings for 6 hours on and above a basic day of 8 or 10 hours of continuous illumination. The flashing light used had periods of 5 sec. on to 5 off; 5 on to 10 off; 5 on to 15 off; 2 on to 10 off. Controls received 14 hours of continuous illumination. Each experiment was performed at least twice. In all cases the birds remained awake under the flashing light. In all the experiments except where the flashes were 5 sec. on to 15 off, the testes were activated. Thus, while the birds were kept awake for the same amount of time in various experiments, the testicular response varied with the lighting and was not influenced by wakefulness. These experiments show that the response to flashing light does not depend on the ratio of on/off, but on the frequency of the flashes. A ratio of 1/5 may be more effective than one of 1/3. The response probably does not depend on the length of the flashes (in terms of seconds); flashes of 2 seconds are as effective as flashes of 5 seconds. These results indicate that the stimulating mechanism (presumably, eye-brain-hypophysis-testis) requires constant or closely repeated stimuli in order to be activated. Further experiments are projected to define this relationship more precisely.

The environmental factors which influence the sexual cycle of wild birds have received little experimental attention. The following data have been secured. Female starlings on long days (day-lengths which will induce spermatogenesis in the male) develop oocytes with a maximum diameter of 3 mm. Oocytes at the time of ovulation have diameters of 13-15 mm. Females on long days mixed with males in a cage with no opportunities for pair-privacy develop oocytes of diameters of 5 mm. (very rarely up to 7 mm.). Females on long days paired with males in cages with nest-boxes develop oocytes up to 10 mm. in diameter. It is evident that long days alone have only a slight influence upon the ovary. The presence of the male augments this response. What phases of the male's presence produces this augmentation is not clear. The act of build-

ing or maintaining nests was found to have no influence. It is suspected that courtship and copulation are important in producing oocytes of ovulation size. Wild females, caught and caged during the breeding season, will ovulate in laboratory cages up to seven days after capture and separation from males. Small laboratory cages do not permit the characteristic aerial courtship of the starling.

- BISSONNETTE, T. H., 1941. Partial Doubling of Both Wings in a Ring-neck Cock Pheasant. *Jour. Hered.* 32 (4): 139-144.
- 1941. The "Mule" Pheasant. *Proc. Amer. Philos. Soc.* 85: 49-70.
- (with BURGER, J. WENDELL). Effects of Intermittent Illumination on the Sexual Cycle of the Male Starling (in progress).
- BURGER, J. WENDELL. Factors Which Influence the Sexual Cycle of the Female Starling (in progress).
- BISSONNETTE, T. H., 1941. Report of Progress. *Yr. Bk. Amer. Philos. Soc.* for 1940: 114-120.

EDWARD P. CHURCHILL, University of South Dakota

Grant No. 436 (1940), \$500. Investigation of the zoeal stages of the blue crab, *Callinectes sapidus*, Rathbun.<sup>1</sup>

During the summer of 1941 the zoeal stages of the blue crab were obtained by hatching the eggs and by the use of large silk townets at various stations near channel buoys in the lower Chesapeake Bay. Zoeae of the blue crab can be distinguished by the long curved dorsal spine, the lateral spines, small spines on the outer side of the telson, the rostrum longer than the antennae, and black chromatophores in each abdominal segment.

There proved to be a prezoal and five zoeal stages.<sup>2</sup> The prezoa is .80 mm. long with spines telescoped and folded against the carapace and the hairs on the maxillipeds invaginated. The entire body is covered with a thin cuticle which within about an hour is thrown off and the spines and hairs extended.

First zoea: .85 mm. long, eyes not stalked, five abdominal segments besides the telson, four hairs on the first and second maxillipeds (third not yet formed).

<sup>1</sup> This investigation was carried out under the auspices of the Chesapeake Biological Laboratory at Solomon's Island, Md.

<sup>2</sup> W. K. Brooks in *Handbook of Invertebrate Zoology*, S. E. Cassino, Boston, 1882, gives a partial description of the prezoa and an account of the first zoea only. Until the present investigation nothing had been added except a drawing of the prezoa in an unpublished Master's thesis by Roy L. Robertson, University of Maryland, 1938.

Second zoea: 1.15 mm. long, eyes partially stalked, five abdominal segments and the telson, six hairs on the maxillipeds.

Third zoea: 1.70 mm. long, eyes stalked, five abdominal segments and the telson, buds of third maxilliped and chela appearing, six hairs on the first maxilliped, seven on the second. Prominent black chromatophores in abdominal segments.

Fourth zoea: 2.20 mm. long, buds of third maxilliped and four pereopods visible, six abdominal segments and the telson, buds of pleopods beginning to show, eight hairs on first maxilliped, nine on second.

Fifth zoea: 2.90 mm. long, six abdominal segments and the telson, buds of third maxilliped and pereopods marked, buds of pleopods large, ten hairs on both first and second maxillipeds.

Megalops: 3.40 mm. long, rostrum projects straight forward.

Usually the first and second zoeae are found in surface tows, the third at both the surface and the bottom and the fourth, fifth, and the megalops at the bottom. It requires about a month for the crab to reach the megalops stage.

KENNETH W. COOPER, Princeton University

Grant No. 484 (1940), \$500. An investigation of the aberrant chromosome behavior in the male germ cells of flies parasitic on tropical bats and vultures (Diptera, section Pupipara).

Interest in the germ cells of bat flies (Streblidae) was awakened by discovery of an anomalous and theoretically significant peculiarity of chromosome behavior in males of *Melophagus*, a fly parasitic on sheep. The phenomena call into serious question the general interpretation of sex chromosome behavior at meiosis in male flies, and so are of considerable importance to geneticist and cytologist alike. Need for additional information, and belief that investigation of streblid bat flies and other relatives of *Melophagus* would perhaps clarify the general issue, led to a search for material in the rain forests and caves of Panama. My gratitude is expressed to Messrs. Paul Barnard, J. B. Shropshire, and Dr. Graham B. Fairchild for taking me to bat roosts, and many other kindnesses. But to Mr. Wallace Kirkland, Jr., I am especially indebted, for without his untiring assistance this undertaking would have been impossible.

The different species of flies were found on bats in a great range of habitats—from hollow trees and human habitations to the limestone caves at Chilibrillo. For example, the curious, wingless and spider-like *Basilia myotis*, described as new to science as recently as 1935, was discovered on the little black bat roosting under laboratory eaves at Barro Colorado Island. Under the sunbaked and blistering galvanized roof of the attic of the Silver (negro and native) Quarters at Summit Agricultural Experiment Station the white-bellied, hare-lipped bat, *Dirias*, was taken in numbers, and from it *Paradyschiria*. The first specimens of the stilt-legged *Speiseria* were found frisking over the fur of bats captured with trammel nets in the cupolas of old sentry boxes. These "sentry boxes" hail from the French days of the Panama Canal, and are still standing in bleached rows along the jungle edge of Orchid Island in Gatun Lake.

Many bats were shot or captured under huge palm leaves, in hollow trees, or on the trunks of enormous *Bombacopsis* trees in the heart of the rain forest. But most specimens of flies and bats were collected in the main chambers of the Chilibrillo Caves some forty miles distant from Barro Colorado Laboratory. Using jacklights and nets, and with the assistance of Kirkland, more than four hundred living bats representing five species were collected in the caves and brought back to the laboratory in cages. At the laboratory the usual proceeding was to have Kirkland hold the bat while it was searched for flies. The flies were trapped in cotton-stoppered vials, and dissection and fixation made as soon as possible. Such a trip to the caves and the resultant laboratory work took, on an average, about twenty hours of the day.

Incidentally it may be remarked that the urge to collect cave animals other than bats was too strong to be resisted. The giant frog *Leptodactylus*—which reputedly eats bats—the singular robber bug *Cavernicola*—known only from the Chilibrillo Caves—some striking fresh water crabs, the huge cave roach *Blaberus*, etc., and several specimens of gigantic and surprisingly beautiful centipedes were captured, among which are two species new to science. The centipedes are being described by Professor Ralph Chamberlin of the University of Utah, while Dr. Phil Darlington of Harvard has been given a relatively large collection of ground beetles made in Panama. Besides these, a collection of bats and several thousand insects and arachnids were preserved, some of which will be

deposited in the collections of the United States National Museum. Specimens of the rare and little known assassin bug, *Parastrongylus* (*Mestor*) *humeralis*,—first described in 1939 and possibly of medical importance—were collected at Barro Colorado and given to the Gorgas Memorial Institute in Panama City.

The belief that the bat flies would prove of unusual interest cytologically has been amply justified. The streblid flies seem to give the first evidences of a material which may assist in binding together homologous chromosomes at the time of germ cell formation in males. Here also the evidence points to an amazing escape of the chromosomes from the nucleus prior to the first maturation division of the sperm-forming cells. Following release of the chromosomes, the old nucleus vanishes, and each pair of chromosomes appears to manufacture its own individual nucleus or karyomere. This seems to be a wholly new phenomenon in male germ cell formation.

The chromosomes of *Olfersia*, a large fly captured on the black vulture, prove to be morphologically intermediate to those of *Drosophila*—the geneticist's prime tool—and *Melophagus*. From the evidence of the vulture fly it would appear that the sex chromosomes are united at maturation in the male by forces identical with those holding the other chromosomes together in pairs of homologues, or bivalents. This is a most important point, for it requires revision of current theory of sex chromosome pairing in flies. Lastly, the collection of nine allies of *Melophagus* gives us our first glimpse of the chromosome sets in the section *Pupipara* of the order of flies.

A technical summary of the more important cytological findings follows.

(1) Meiosis in the streblids seems to take but one course, which may be typified by a brief account of the more salient features of *Trichobius dugesii* Town. The first spermatocyte is formed following the sixth gonial telophase, and at the onset of the meiotic prophase it is the smallest cell of the apical half of the testis. The chromatin appears in five unequal heterochromatic clumps distributed about the nuclear periphery. A large plasmosome is present. As the primary meiocyte grows, the nuclear membrane appears to vanish at each contact with a heterochromatic clump. The heterochromatic bodies pass into the cytoplasm, and each becomes enclosed within an individual karyomere. Meanwhile the plasm-

some and vestiges of the former nucleus vanish from view. Each heterochromatic element develops or is associated with a non-chromatic body to which it thereafter remains attached. At a stage prior to diakinesis the heterochromatic material within each karyomere evinces its duality and the non-chromatic material, at least in part, appears to be interstitial to the paired heterochromatic bodies. In diakinesis the bivalents condense to their meiotic metaphase forms. During condensation it appears that the non-chromatic material is incorporated in the bivalent structure. The karyomere outlines disappear, and the reductional first meiotic division ensues. At this time the bivalents are similar to those of Asilidae, and are typically like those of many brachycerous Diptera. No chiasmata (hence no crossing-over) need be assumed from their structure. Indeed the absence of the customary leptotene, pachytene, and diplotene sequences precludes the possibility of a chiasmatype meiosis. The essential importance of the meiotic phenomena in the streblids would appear to lie in the possible rôle of at least a part of the interstitial, non-chromatic material. Ordinarily somatic pairing forces are at their lowest value in metaphase of mitosis. The non-chromatic substances in some measure may maintain at meiotic metaphase the associations established in prophase by forces of somatic pairing.

(2) The hippoboscid *Olfersia bisulcata* Macq. is a case of very great significance, linking as it does the peculiarities of the *Drosophila*-type of meiosis with those of the hitherto unique *Melophagus ovinus* L. (Cooper, 1941). The diploid chromosome group of the male comprises a pair of V-shaped autosomes, a pair of elongate rod-shaped autosomes, a pair of dot-like autosomes, and an asymmetrical XY pair. Like *Drosophila* but unlike *Melophagus* are the bivalent forms assumed by the V-shaped and dot-like autosomes, and the sex chromosomes of *Olfersia*. As in *Melophagus*, however, the rod-shaped autosomes form a bivalent by intimately pairing in a *localized, terminal segment*. Since both the rod-shaped autosomes (like the autosomes of *Melophagus*) and the sex chromosomes give the same evidences that have been held indicative of *reciprocal chiasmata* in the sex chromosomes of *Drosophila*, both or neither of these bivalents may be assumed to be associated by reciprocal chiasmata. The bivalent associations of the V-shaped autosomes need not be attributed to chiasmata of any sort. Inasmuch as the rod-shaped autosomes form a bivalent which in

principle differs from that of the V's only in length of association, the simpler conclusion is that chiasmata are not involved in the formation of any of the bivalents. Accordingly, the hypothetical interpretation of the anomalous meiosis in male brachycerous *Diptera* may be freed of the complicating element of reciprocal chiasmata in sex chromosome associations unless positive evidence to the contrary is established.

(3) Cytological material was secured in Panama of nine species of parasitic flies representing among them the three recognized families of *Pupipara s.s.* (i.e., excluding the *phoroid* *Braulidae*). The following list is the first record of the chromosome numbers of *Nycteribiidae*, *Streblidae* and an avicolous member of the *Hippoboscidae*. Dividing cells from which chromosome counts have been made include those of the female embryo, male embryo, male gonidia, male first and second meiocytes, as well as spermatids. These are symbolized: ♀ E, ♂ E, G, M1, M2 and tid, respectively. The specimens were kindly identified by Dr. Jos. C. Bequaert of the Harvard Medical College.

#### *Diptera*: section *Pupipara*

##### *Nycteribiidae*:

*Basilia myotis* Curran,  $2n = 10$  (G),  $n = 5$  (M2).

##### *Streblidae*:

*Euctenodes mirabilis* Wat.,  $n = 5$  (M1, M2).

*Paradyschiria dubia* Rudow,  $n = 5$  (M1).

*Pterellipsis aranea* Coq.,  $2n = 10$  (G),  $n = 5$  (M1, M2).

*Aspidoptera buskii* Coq.,  $n = 5$  (M1, M2).

*Speiseria ambigua* Kess.,  $2n = 10$  (G),  $n = 5$  (M1, M2).

*Trichobius dugesii* Town., (= *blandus* Curran),  $2n = 10$   
(♀ E, ♂ E, G),  $n = 5$  (M1, M2, tid).

*T. caecus* Edw.,  $n = 5$  (M1, M2).

##### *Hippoboscidae* (*Olfersiinae*):

*Olfersia bisulcata* Macq.,  $2n = 8$  (G),  $n = 4$  (M1, M2).

The apparently constant  $n = 5$  among the species of *Streblidae* and the *nycteribiid* is by no means associated with a constant set of chromosomes of identical variation or structure. Each species for which gonial cells have been studied may be recognized by its specific complement of Js, Vs and rods. Nevertheless, the chromosome groups of the *streblids* and *nycteribiid* have striking similarities, and in turn are markedly different from that of *Olfersia*

bisulcata. In contrast to the numerical homogeneity of garnitures existing among the investigated streblids, the hippoboscids *Olfersia* ( $2n=8$ ) and *Melophagus ovinus* L. (Lipopteninae) ( $2n=18$ , Cooper 1941) differ radically both in chromosome number and karyotype.

Except for *Trichobius caecus*, it has been possible to recognize an inequality in form, size, or both, of the sex chromosomes in the male of each species studied.

J. KENNETH DONAHUE, College of Charleston

Grants No. 208 (1938), \$500, and 491 (1940), \$150. The occurrence of estrogenic substances in the ovaries of certain marine invertebrates and vertebrates.

In my report for the 1938 YEAR BOOK it was stated that extracts of the ovaries of the Bermuda sea urchin, *Lytechinus variegatus*, contained estrogens as indicated by the effects of injections of these extracts on the vaginal epithelium of ovariectomized rats.<sup>1</sup> Included in that report was a brief statement dealing with the preparation of extracts of the ovaries of four other invertebrates collected in Bermuda, namely, *Stichopus mobii*, *Panulirus argus*, *Echinometria*, and *Tripneustes esculentus*. These extracts were all prepared by repeated extractions of the tissues with ethyl alcohol, acetone, and ethyl ether and concentrating the extracts by distillation under reduced pressure. Usually the oily residues were combined; occasionally the fractions were tested separately. In all cases estrogenic activity was present as indicated by later tests.

Unfortunately purification procedures require such large amounts of starting material that few invertebrate sources are adequate for this work. It was considered desirable, therefore, to turn to certain of the common food fishes for adequate supplies of ovarian material. Extracts of the ovaries of the winter flounder (*Pseudopleuronectes americanus*) and the cod (*Gadus morhua*) have been recently prepared in the manner described above. A report on the former has been published. The latter are now being tested. Within the past few weeks a large batch of mullet roe (*Mugilus cephalus*) has been extracted and carried to a further stage of purification than any of the extracts prepared up to this time. Ad-

<sup>1</sup> Donahue, J. K., and Jennings, E. D., 1937. The Occurrence of Estrogenic Substances in the Ovaries of Echinoderms. *Endocrinology* 21: 690-691.



vantage is taken of the fact that most fatty material, but not the sterols, can be removed by saponifying the alcohol extract with an excess of KOH. Further extractions of the alcohol solution with ether followed by repeated washings of the ether layer with water appear to get out most of the sterols. After the ether of the combined ether extracts evaporates off a crystalline mass carrying a bright orange pigment remains. This substance gives positive furfural, Salkowski, and Liebermann-Burchard tests, indicating the presence of sterols. Preliminary colorimetric analysis, based upon modifications of the Kober test, indicates the presence of estrogenic material. The assay of this particular extract by colorimetric methods is being attempted. The technical assistance of Mr. Robert Bruce and Mr. Lee Muller is hereby gratefully acknowledged.

DONAHUE, J. K., 1939. Estrogenic Properties of Extracts of Ovaries of Certain Marine Invertebrates. *Proc. Soc. for Exp. Biol. and Med.* 42: 220-222.

— 1940. Occurrence of Estrogens in the Ovaries of Certain Marine Invertebrates. *Endocrinology* 27: 149-152.

— 1941. Occurrence of Estrogens in the Ovaries of the Winter Flounder. *Endocrinology* 28: 519-520.

HERBERT L. EASTLICK, Washington State College

Grant No. 533 (1941), \$200. Studies on transplanted embryonic limbs of chicks.

Limb buds of 26 to 35 somite chick embryos were transplanted into the intra-embryonic coelom of hosts of similar age. The grafts were removed at intervals ranging from one day after the operation up to a day beyond hatching. Formol-Zenker and Bouin's fluid were used as fixatives. The grafts were dehydrated, embedded in paraffin and serially sectioned in the usual manner. Sections were stained with Heidenhain's iron-haematoxylin, Mallory's triple stain, Heidenhain's azan, Bodian's activated protargol-reduced silver and Delafield's haematoxylin eosin-azur II.

Forty nerveless or poorly innervated grafts varying from 4 to 10 days of age have been examined, macro- and microscopically. In general the grafts are smaller than normal limbs of the same age. Study of sections reveals that differentiation has not proceeded as rapidly in the grafts as in controls. Differentiation of mesenchyme cells into myoblasts begins to occur in some 6½ day grafts. Homogeneous non-striated fibrillae occur in the muscle cells of 7 to 10 day

limbs. Typical cross-striated fibrillae occur in the 9 to 10 day stages. None of the nerveless 10 day grafts possess extensive areas of cross-striated fibers since the most advanced 10 day specimen possessed approximately as many striated fibers as a 7½ day control.

Macrophages, which are present in 7 day grafts, were found to engulf fibroblasts, blood cells and the nuclei of the myoblasts. Preliminary observations indicate that all the muscle disappears in non-innervated grafts before the time of hatching of the host and fatty tissue takes the place of the muscle. At the present time, the origin of these fat cells is not known.

Extensive erythropoiesis and granulopoiesis occurs in transplanted limbs. Granulocytes which are numerous in 8 day transplants are extravascular and usually found just external to the perichondrium. They appear to be developing from haemocytoblasts.

A study of the older grafts is now in progress.

HENRY W. FOWLER and RICHARD A. MCLEAN, Academy of Natural Sciences of Philadelphia

Grant No. 32—Johnson Fund (1941), \$360. Study of fishes and invertebrates of the southern Piedmont and coastal plain, with special reference to the Pedee and Santee River basins of the Carolinas.

### *The Fishes*

Extensive collections of fishes in the Charleston and North Carolina State Museums were examined and studied. The data, notes and drawings were made from various specimens, several hundreds of which were determined and written into a forthcoming report now in preparation.

Field work comprised an automobile collecting trip starting from Philadelphia to Maryland and Virginia, in the latter state specimens secured in the Shenandoah, near Natural Bridge and New River. In North Carolina we collected in many of the headwaters of the Catawba basin, with our chief quarters at Marion. In upper South Carolina we visited a number of headwater streams of the Savannah River basin, especially about Walhalla. Then again we went over into North Carolina about Sylva, Roaring Gap and Little River. Finally we collected again in Virginia about Lexington. In all over five hundred fishes were preserved and placed in the mu-

seum of the Academy, along with some crustacea and other water animals.

The scientific results, chiefly ichthyological, permitted the examination and study in the field of at least twenty or more little known fishes, besides the discovery of one very rare, if not entirely new.

### *Invertebrates*

The field work consisted of a trip by automobile through North Carolina, South Carolina and Georgia. The marine material secured is of particular interest because this region is intermediate between the tropical and boreal provinces. It is being used in studies of the origin and relationships of many of the groups concerned. A very fine set of marine organisms which foul oyster beds was secured in South Carolina and has already been used as comparative material in studies of local conditions in Delaware Bay.

DWIGHT LUCIAN HOPKINS, Mundelein College, Chicago

Grants No. 344 (1939), \$250; No. 344a (1939), \$487; and No. 534 (1941), \$250. Studies of the adaptation of amoebae to changing concentration and the regulation of the water content of the protoplasm.

It has been shown that in the fresh water amoeba, *Amoeba lacerata* Dujardin, which lives and reproduces well in spring water, sea water or any dilution of sea water, the water content varies directly with that of the external medium; that the contractile vacuoles contain osmotically active substances—wastes—which cause the absorption of water by the vacuoles, and which are eliminated along with the absorbed water. The contractile vacuoles act as osmoregulators in the sense that substances which would cause excessive osmotic pressures internally are eliminated. These results with *Amoeba lacerata* agree with those obtained in collaboration with Dr. S. O. Mast on *Amoeba mira*, a marine amoeba which can live and reproduce in any dilution of sea water as great as a twenty fold dilution (5 per cent sea water) or in any concentration as much as six or eight times.

The studies have been extended to a number of other amoebae, (1) *Amoeba verrucosa*, a large fresh water form which can live for a time in 45 per cent sea water, but which so far has not been ob-

served to reproduce well above 15 per cent sea water; (2) an unnamed fresh water amoeba, a small irregularly shaped amoeba which cannot live and reproduce above 20 per cent sea water; (3) a small marine limacine amoeba which cannot live below 75 per cent sea water; and (4) a fresh water limacine amoeba which can live and reproduce as high as 40 per cent sea water. Except for *Amoeba verrucosa* the study so far has consisted in ascertaining the extent of their osmotic tolerance.

A study of the cytology of *Amoeba verrucosa* has been made. Food ingestion and the formation of food vacuoles by the coalescence of neutral red vacuoles with the ingested food were observed to be essentially the same as in *Amoeba mira* and in *Amoeba lacerata*. The development of contractile vacuoles could be traced, more definitely than in previously studied forms, from rod-shaped or spherical bodies (granules or vacuoles?) which are brought to the posterior end through the plasmagel and there swell and coalesce to form large contractile vacuoles. Coalescence of the vacuole membrane with the plasma membrane results in the elimination of the fluid contents of these larger vacuoles. The membranes of vacuoles whose contents have escaped to the exterior remain inside and most always form a vacuole anlagen with which the small vacuoles or granules above mentioned will coalesce.

HOPKINS, DWIGHT L., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 192-193.

— 1941 (with MAST, S. O.). Regulation of the Water Content of *Amoeba mira* and Adaptation to Changes in the Osmotic Concentration of the Surrounding Medium. Jour. Cell. and Comp. Physiology 17: 31-48.

— 1941. Cytology of *Amoeba verrucosa*. Biol. Bull. 81: 299-300.

HARRISON R. HUNT and CARL A. HOPPERT, Michigan State College  
Grant No. 370 (1939), \$425. Inheritance in rat caries.

The anthropological researches of Dr. Morris Steggerda led him to suggest that the writers investigate the inheritance factor in caries, using the rat as an experimental animal.

The study was begun early in 1937. Hoppert had already worked out a diet which would cause caries in the lower molar teeth of the rat. This diet consists of coarsely ground rice, powdered milk, alfalfa leaf meal, and salt.

A random group of rats was fed this caries-producing diet. Considerable variation was found in the time required for different individuals to show cavities in the teeth. A susceptible line and a resistant line have been developed by inbreeding and selecting among the descendants of these first generation rats.

The phenotype provides a very poor basis for selecting breeders. The progeny of a breeding pair, as well as the behavior of the breeders themselves, must be considered before picking a pair of animals for continuing either line.

The following table presents a summary of what has been accomplished. Work on the caries-resistant line has proceeded much more slowly than on the susceptible line. The susceptible animals develop caries relatively early whereas the resistants may require months. The times given are the number of days required for the development of tooth cavities after the animal has been put on the caries diet at thirty-five days of age. The numbers are averages of sibship means in the different generations and lines.

| Generation | Susceptible Line      | Resistant Line         | Differences |
|------------|-----------------------|------------------------|-------------|
| 2          | 56 days ( 8 sibships) | 116 days ( 8 sibships) | 60 days     |
| 3          | 43 " (11 " )          | 142 " (18 " )          | 99 "        |
| 4          | 37 " (13 " )          | 167+ " (16 " )         | 130+ "      |
| 5          | 32 " (14 " )          |                        |             |
| 6          | 29 " (11 " )          |                        |             |
| 7          | 38 " ( 9 " )          |                        |             |

The susceptible line now shows low variability, suggesting that homozygosity has been attained. On the other hand, the resistant strain shows high variability, indicating a high percentage of heterozygosity among the genes for caries resistance.

We have demonstrated that heredity is a factor in causing differences in resistance to caries in rats. Our next problem is to determine, if possible, the numbers of genes involved and the modes of action of these genes. When the resistant line becomes homogeneous, it will be crossed with the susceptible and the first generation will be inbred and back crossed to determine, if possible, the number of genes involved and the action of each gene.

HUNT, H. R., 1939 (with HOPPERT, C. A.). Report of Progress. Inheritance in rat caries. (Abstract.) *Genetics* 24: 76.

WALTER LANDAUER, University of Connecticut

Grant No. 418 (1940), \$800. The numerical distribution of anterior horn cells in the pelvic spinal cord of polydactylous fowl. (This project was carried out by Mrs. Lisbeth Baumann.)

Polydactyly is a dominant hereditary trait of fowl. This trait is characteristic of certain breeds (Houdan, Dorking, Silkie), and birds belonging to these breeds generally have five toes on each foot, instead of the four toes characteristic for ordinary breeds of poultry. Upon crossing polydactylous and non-polydactylous chickens, it is found that in the progeny the polydactylous character is frequently expressed on only one foot. The asymmetrical occurrence of polydactyly has considerable general interest with regard to problems concerning the mechanism of gene expression. Selection experiments are in progress at this institution in which an attempt is made to fix the different symmetry types of polydactyly within certain family lines.

In addition to genetic studies, relative to the symmetrical or asymmetrical expression of polydactyly, this material is to be used for an analysis of the developmental processes which are imposed upon the organism by the presence of the polydactyly factors.

One phase of these studies is concerned with the numerical distribution of motor neurons in the spinal cord of polydactylous chickens. The necessity of such investigations was indicated by the claim of one author<sup>1</sup> that asymmetrical polydactyly of mice is not only associated with the presence of a large number of anterior horn cells on that side of the spinal region which innervates the particular extremity, but that this hypertrophy of motor cells actually precedes the appearance of polydactyly in development.

The first steps in a study of this kind had to be concerned with the proper identification of the various types of motor nerve cells which occur in the lumbo-sacral cord of fowl. The following classes of cells were established: ventro-lateral, dorso-lateral, retro-dorso-lateral, central, and mesial. The functional significance of some of these cell groups is still in doubt. It appears certain, however, that the retro-dorso-lateral cells are chiefly, if not entirely, related to the innervation of the foot. Any differences in the numbers of motor cells on the two sides, associated with polydactyly, should, therefore, show up in this group of cells. Careful counts were

<sup>1</sup> Tsang, 1939, Jour. of Comp. Neur. 70.

made of all these motor cell types, but reference will here be made to only a few of the results. The distribution of retro-dorso-lateral cells within the left and right half of the lumbo-sacral region of the spinal cord of seven adult birds is shown by the figures in table 1. These data demonstrate that in animals which have the same number of toes on each foot (i.e., animals with either four or five toes bilaterally), the numbers of retro-dorso-lateral cells on the two sides are nearly identical. On the other hand, there is a defi-

TABLE 1

| Designation of Animal | Sex | Number of Toes |       | Number of Retro-Dorso-Lateral Cells * |       | Percent of Retro-Dorso-Lateral Cells on <i>Right</i> Side |
|-----------------------|-----|----------------|-------|---------------------------------------|-------|-----------------------------------------------------------|
|                       |     | Left           | Right | Left                                  | Right |                                                           |
| J                     | ♀   | 4              | 4     | 291                                   | 250   | 46.2                                                      |
| IV                    | ♂   | 4              | 4     | 314                                   | 348   | 52.6                                                      |
| B                     | ♀   | 5              | 4     | 360                                   | 243   | 40.3                                                      |
| G                     | ♀   | 5              | 4     | 416                                   | 263   | 38.7                                                      |
| K                     | ♀   | 5              | 4     | 458                                   | 286   | 38.4                                                      |
| O                     | ♀   | 5              | 4     | 297                                   | 208   | 41.2                                                      |
| I                     | ♂   | 4              | 5     | 557                                   | 704   | 55.8                                                      |
| II                    | ♂   | 4              | 5     | 343                                   | 548   | 61.5                                                      |
| L                     | ♀   | 5              | 5     | 129                                   | 125   | 49.2                                                      |

\* The totals of cells are not strictly comparable from individual to individual since there are minor variations in the number of sections from which counts were made.

nately asymmetrical distribution of retro-dorso-lateral cells in all cases of asymmetrical expression of the polydactylous character. In animals with five toes on the left foot and four on the right the number of retro-dorso-lateral cells is larger on the left side; conversely, in animals with four toes on the left and five on the right foot, the number of retro-dorso-lateral cells is larger on the right side. It can be concluded, then, that asymmetrical polydactyly of fowl is associated with homolateral asymmetry in the number of retro-dorso-lateral cells in the lumbo-sacral enlargement of the spinal cord. This difference in distribution of the retro-dorso-lateral cells holds true throughout the whole extent of the spinal cord within the lumbo-sacral region. No similarly striking differences were found for the other motor cell groups, although less pronounced differences of the same nature probably exist with regard to some of them, e.g., the dorso-lateral cells.

Further studies, which are now in progress, will deal with embryonic stages.

J. F. McCLENDON, Hahnemann Medical College

(Grant No. 374 (1939), \$300. The relation of the fluorine content of certain diets to the incidence of dental caries in experimental animals.

Because no reliable methods for the determination of fluorine in diets that would produce dental caries in rats existed, a method was developed. This consisted in burning the diet in a platinum tube furnace with automatic stoker and distilling the ash in a micro-still of new design. Colorimetric analysis involved a spectrophotometric study of alkaline and acid alizarin and alizarin-thorium lake in order to determine the best pH for the titration of fluorine with thorium. The pH was adjusted in each analysis with the glass electrode. A theory of the method was developed from a study of the change in "dissociation constant" of alizarin due to presence of excess thorium over that required to bind the fluorine.

Evidence the recipient has collected for twenty years indicates that fluorine is beneficial for the teeth whereas the majority of workers were interested only in the toxic effects of fluorine. This is the first investigation in which fluorine content of a dental caries-producing diet was determined (viz. 0.3 part per million).

A diet of 40 parts low fluorine yellow corn, 40 brown rice, 14 low fluorine skim milk powder, 9 corn oil and 1 fluorine-free salt produced caries in 100 per cent of weaned rats fed on it. There was without additional fluorine an average of 1.5 carious teeth per rat in 40 days, 3 in 75 days, 3.3 in 90 days, 3.5 in 100 days, 4 in 150 days and 5 in 230 days. On the addition of 9 parts per million of fluorine to the drinking water there were no caries in 100 days and only 2 in 230 days. Seven to 10 ppm. fluorine gave similar results. But with 4.5 ppm. there was 1 carious tooth per rat in 150 days, 2 in 160 days and 3 in 230 days.

Adding 0.2 per cent cod liver oil or 1 per cent of bone salts to the diet delayed caries, but not as much as adding 1.8 ppm. fluorine to the drinking water. Since the cod liver oil was presumably fluorine-free and the other addition by analysis did not increase the fluorine content of the diet more than 0.03 part per million, the effect was probably not due to the fluorine.

The addition of fluorine to the drinking water increased the



fluorine content of the dentine 6 times, tooth enamel 3 times and bone 11 times.

MCCLENDON, J. F., 1941 (with FOSTER, W. C.). Determination of Dietary Fluorine. *Ind. and Eng. Chem. Anal. Ed.* 13: 280-283.

— 1941 (with FOSTER, W. C.). The Effect of Dietary Fluorine in Delaying Dental Caries (In press).

JOHN A. MOORE, Brooklyn College  
(now at Queens College)

Grant No. 535 (1941), \$300. Studies on embryonic temperature tolerance and rate of development in frogs from different latitudes.

Previous investigations have revealed that northern and southern species of frogs differ in embryonic temperature tolerance and rate of development. Northern species can withstand lower temperatures in early stages than southern species. Southern species on the other hand are more resistant to high temperatures. Northern species are also characterized by a rapid rate of development. A study of these embryological characters in individuals of the same species but from different latitudes is now in progress. This year experiments have been conducted on eggs of *Rana catesbeiana*, *Rana clamitans*, and *Rana pipiens*.

*Rana catesbeiana* eggs from Rossie in north-central New York and from the Adirondack Mountains (elevation 2000 feet) have the same temperature tolerance and rate of development as those from southern Louisiana.

*Rana clamitans* eggs from the Adirondack Mountains (elevation 2000-4000 feet) have the same rate of development and lower limiting temperature as those of the same species from the lowlands of Massachusetts.

*Rana pipiens* (or *sphenoccephala*) eggs from Louisiana can withstand higher temperatures than eggs from Quebec, Vermont, Wisconsin, or New Jersey. From the latter localities the upper limiting temperature is 28-29°. For Louisiana eggs it is 32-33°.

EDWARD P. MUMFORD, Oxford and Stanford Universities

Grant No. 498 (1940), \$250. The study of faunal distribution with particular reference to oceanic islands. (This project is being directed by Professor G. D. Hale Carpenter of Oxford University.)

In seeking a wider approach to the basic problem of the origin of species, the Higher Studies Fund at Oxford, the Royal Society,

the British Association for the Advancement of Science, and other subscribers initiated in October 1938 an international study of island populations.

Since the outbreak of the war, this cooperative project has been carried on in the Department of Biology at Stanford University, with the aid of grants from the American Philosophical Society, the Carnegie Corporation of New York, the National Academy of Sciences, the American Association for the Advancement of Science, the Society of Sigma Xi, the May Esther Bedford Fund, Inc., and private subscribers.

Professor G. D. Hale Carpenter of Oxford, who is directing the project, is Secretary of the British Association Committee for the study of insular faunas, and the Royal Society's representative on the international Committee for the study of Pacific faunas. Mumford who, as a member of the Stanford faculty on leave from Oxford, is carrying on the project under Carpenter, reports that considerable progress has been maintained and that a number of technical papers are in the course of preparation for publication in 1942. Completion of the project is planned for 1943.

Since 1938 Mumford has been accumulating, under Carpenter's direction, extensive data from the field, laboratory, museums, and the literature. This is on file as notes, correspondence and catalogues, and much of it is to appear in print in 1942. The extensive card indices refer not only to the terrestrial and fresh-water fauna *in its entirety* but in many cases to the host plants and the localities from which the fauna came. Included as far as possible are all known records of the non-marine fauna from some fifty specified island groups in various parts of the world. These representative island groups were decided upon from information supplied to Carpenter by leading authorities in the National Academy of Sciences and the American Philosophical Society.

These data will form the basis not only of a series of technical papers, but also of a single source book on island populations. Such a standard work, bringing up to date Alfred Russel Wallace's classic *Island Life* of 1880, but written with the new approach, should, it is felt, fill an important gap in modern biological literature. The problem of genetic and physiological isolation has been ably dealt with by Dobzhansky and his associates, but much is yet to be done on island populations from the standpoint of geographical isolation in relation to the origin of species.

In *Island Life*, Wallace concluded that the difference in origin between oceanic and continental islands is fundamental, and "leads to a most important difference in their animal inhabitants." As a result of the present studies, however, it seems that many of these differences are breaking down. The absence of certain groups is often quoted as strong evidence against the existence of extensive land areas at any time in the past, but the facts of distribution are that such groups do occur in supposedly oceanic islands or are absent both from the oceanic and adjacent continental islands alike. Of what were once considered absentees, the froghoppers (Cercopidae) are now known to have evolved what appear to be peculiar forms in supposedly oceanic Samoa, the Society Islands, Tuamotus, and Rapa; the cicadas have a remarkable new endemic genus in Samoa; and caddis-flies (Trichoptera) and back-swimmers (Notonectidae) among the aquatic Hemiptera are known from Samoa and the Society Islands. Saw-flies (Hymenoptera-Symphyla) and tree-hoppers (Membracidae), admittedly, may be absent from the native fauna of supposedly oceanic islands, though present in the continental islands adjacent. Scorpion-flies (Mecoptera) and alder-flies and snake-flies (Neuroptera-Megaloptera), however, appear to be absent from both, and the stone-flies (Plecoptera) are represented in the near-by continental islands only by an extremely doubtful record from Fiji.

Articles on the project as a whole are in the course of preparation for publication in *Science* and *Nature*.

OLIN E. NELSEN, University of Pennsylvania

Grant No. 548 (1941), \$100. Reproductive phenomena of the opossum.

Observations have been made on various aspects of reproductive phenomena in the female opossum induced by gonadotropic hormones. The two main hormones being used are the luteinizing factor of pregnancy urine present in Antuitrin-S (Parke-Davis Co.) and the gonadotropic factor (FSH) prepared from the anterior lobe of the hypophysis (Ayerst, McKenna, and Harrison). It has been found possible to induce ovulation and the accompanying oestrous changes during the anoestrous condition of the animal by injecting both of these hormones subcutaneously. The preliminary injections of the follicle stimulating factor are followed by a

combination of FSH plus the luteinizing hormone. The latter combination effects ovulation.

Recently it has been shown that it is more efficacious to inject the ovulating dosage intraperitoneally, as the general results of this procedure elicit responses in the ovary and accessory organs which simulate more closely the conditions of naturally occurring ovulation and oestrus.

The ovarian response shows considerable variation. A histological study of ovaries shows that the number of ovulation points present on the surface of an ovary as a result of the induced ovulation treatment is not an exact indication of the number of eggs ejected. The following general conditions may be present in such an ovary: (1) follicular atresia in which the egg is encased by the luteinization process; (2) partial luteinization of the follicle with the egg free; no rupture of surface tissue; (3) same as 2, but with the surface tissue of the follicle slightly ruptured; (4) slight luteinization of the follicle, the egg free in the follicular fluid, and (5) luteinization of the follicle with the egg ejected and a well-developed ovulation point.

Mating following induced oestrus has not been really successful thus far. Three successful matings with offspring produced have been observed in a group of thirty opossums studied, although seven females received the male. This study was made on females in the dioestrous condition as revealed by the vaginal smear and the authors regard this percentage of success with considerable question.

NELSEN, OLIN E., 1941 (with WHITE, ELIZABETH L.). A Method for Inducing Ovulation in the Opossum (*Didelphys virginiana*). *Anat. Rec.* 81: 529-535.

— 1941 (with MAXWELL, NANCY). Induced Oestrus and Mating in the Opossum, *Didelphys virginiana*. *Anat. Rec.* 81 (Suppl.): 105.

— 1941. The Ovarian Response to Gonadotropic Hormones in the Opossum, *Didelphys virginiana*. *Anat. Rec.* 81 (Suppl.): 106.

DAVID S. PANKRATZ, University of Mississippi

Grant No. 468 (1940), \$250. The development and behavior of the pouch opossum, correlated with development of the nervous system.

Young opossums were taken from the pouch and immediately either photographed or placed in an incubator. They were then observed for spontaneous and elicited movements, which were photographed.

In the recently born, movements of the trunk began in the head or neck region and progressed caudad as an integrated system which effected alternate movements of the forelimb, with head extended and moving from side to side. Alternating movements of the forelimbs were accompanied by a grasping of any suitable object with which they came in contact. Thus they raised themselves to an upright position supported by snout, rump and forelimbs, and also crawled. Before the seventh day the hindlimbs moved only with the rump.

The first movements of the hindlimb were seen in pouch young 7 to 8 days old (17 mm. c. r.). The "flip reaction" was also obtained. Stimulation on the hindlimb with heat, a sharp needle, a bristle or amputation caused no reaction at this age.

During the next few days the simple hindlimb movements became more complex and coordinated with the forelimb into what is essentially a walking gait. Reactions to heat, pin prick and bristle appeared only after movements were well established. Cutting of the dorsal roots in the lumbo-sacral region abolished all reflexes in the hindlimb, but spontaneous movement was retained.

The spinal cord has been cut at the lower thoracic level in a series of pouch young and older stages. This operation produced relatively little spinal shock. In all stages reflexes appeared within one hour and crawling or walking movements were present.

Motion pictures were also made to show sucking, grasping, crawling, walking, righting and feeding behavior. Two series of young, about 110 days old, were used in maze learning experiment. The results indicate that the opossum learns to run a simple maze in approximately the same time as a white rat.

Histological studies of the early motile hindlimb and of the transected cords are being made.

PANKRATZ, D. S., 1941. Cinematographs of the Behavior of Pouch Young and Later Stages of the Opossum. *Anat. Rec. Suppl.* 79: 94.

JAMES A. G. REILN, Academy of Natural Sciences of Philadelphia  
Grant No. 38—Johnson Fund (1941), \$500. An Orthoptera survey of certain northwestern states.

*Purpose.* The general objective of the survey was to supplement field investigations on the same order of insects made in that general territory in the years 1909, 1910, 1919, 1922 and 1928 by

James A. G. Rehn and Morgan Hebard, under the auspices of the Academy of Natural Sciences of Philadelphia. The previous work had brought to light striking localizations in the Northwest of otherwise more broadly distributed genera, particularly some now known to be definitely Asiatic in relationship. The present study was undertaken to acquire more detailed data where positive information could be secured, or conversely negative information of virtually equal scientific value. The previously available evidence suggested Pleistocene glaciation as a factor which had produced many of the present puzzling distributional patterns of non-alate forms of Orthoptera, particularly in the states of Washington and Oregon.

*Time Spent in Field.* From July 11 to September 4, 1941, was spent in carrying out the survey. The cost of the survey over and above the grant was contributed by the recipients. All travel was by automobile.

*Summary of Work.* Examinations were made of 180 different stations extending from western Nebraska and Colorado to Washington, Oregon and north-central California, where contact was made with areas examined in similar fashion in 1937. The localities on which efforts were particularly concentrated were located in Washington, Oregon and northwestern California. The stations examined ranged in elevation from sea-level in Washington, Oregon and California to 9,666 feet in Wyoming, 6,400 in Washington, 7,000 in Oregon, 9,634 in California and 12,200 in Colorado. The total mileage travelled was 10,706.

*Material Secured.* Aside from the large and vitally important amount of observational information secured, collections of 9,180 insects were made, of which 5,265 were Orthoptera. Preparation work on this material has already been taken up by an Academy preparator, the work of mounting and labelling being a necessary preliminary before laboratory study is possible.

*Preliminary Survey of Results.* Prior to the completion of a full systematic study of the material secured it is not possible to do more than point out the general trend of the evidence secured. It is clear, however, that certain boreal types, often of Asiatic affinities, which are well represented in or near timber-line conditions in the main Cascade Mountains, and on the closely placed old volcano of Mt. Rainier, have no analogs in the same habitats on the more westerly old volcano of Mt. Baker or the Olympic Range

of the Olympic Peninsula, and that lower levels of the entire Puget Sound area have an extremely attenuate orthopterous fauna. The explanation apparently is that the great Puget Sound lobe of the ice sheet, so well developed in southern British Columbia, and which extended relatively high on the slopes of the abutting mountain masses, extirpated these types, most of which are flightless, and that their reestablishment since has not taken place. Most of the lower level forms of the Puget Sound area are representatives of widely distributed west American types which apparently have been able to repopulate the territory, while a large number of other genera common to territory to the South and East are as lacking as the more northern types of Asiatic affinities. The work in Oregon proves that Pleistocene conditions there were much less disastrous on the Orthoptera than in Washington and our knowledge of the rich fauna of the state has been much increased. The sum total of results has been to make available a far more comprehensive and detailed assemblage of facts on the distribution, faunal relationship and history and systematics of the Orthoptera of the northwestern United States than was previously available. Integrated with the work of previous investigations we now have the basic evidence for very definite conclusions previously only intimated.

CARL CASKEY SPEIDEL, University of Virginia

Grants No. 312 (1939), \$400, and No. 410 (1940), \$250. Investigation with the aid of ciné-photomicrography of the reactions of cells and tissues in living frog tadpoles as the animals are subjected to various experimental conditions.

Further work has been done along the lines reported in the last two YEAR BOOKS of the Society. Some of the results have been presented before the Harvey Society of New York and published in *The Harvey Lectures*. Several brief abstracts covering certain phases of the work have also been published. Other results are described in detail in two papers now in press, as listed below.

Many new ciné-photomicrographs of tissue changes in frog tadpoles have been made directly from the living animals. The micro-polariscope was effectively used in recording myelin sheath changes in nerve fibers. Examples were obtained showing the variations in anisotropy of the myelin sheath during growth, extension, inter-

calation of a segment, irritation, degenerative transformation, and ingestion of myelin débris by macrophages. Other pictures show reactions of epithelial cells to electric shocks, to insulin, and to nearby wounds inflicted by cutting. Recovery changes are also shown. Other pictures include shock changes in blood cells, blood vessels, and pigment cells; also various movements of leucocytes, such as passage into a lymph or blood vessel, movements among the epithelial surface cells, ingestion of a vacuolated epithelial cell by a macrophage, and movements of macrophages within the central canal of the spinal cord. A few additional pictures were also made of contracting cardiac muscle fibers in excised strips of *Limulus* heart.

- SPEIDEL, C. C., 1940-41. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 292-294; for 1940: 251-252.
- 1941. Adjustments of Nerve Endings. The Harvey Lectures, Series 38: 126-158.
- 1941. Experimental Modifications of Nerve Ending Patterns. Anat. Rec. 79: Supplement 2: 57. (Abstract only.)
- 1941. Irritation and Recovery of the Bristles of the Sensory Cells of the Lateral-Line Organs. Anat. Rec. 79 Supplement 2: 79. (Abstract only.)
- 1941. Ciné-photomicrographs Showing (1) the Salvaging of Extravasated Erythrocytes by Lymph Vessels, and (2) the Reactions During Irritation and Recovery of the Bristles of Sensory Cells of the Lateral-Line Organ. Anat. Rec. 79 Supplement 2: 97. (Abstract only.)
- 1942. Studies of Living Nerves. VII. Growth Adjustments of Cutaneous Terminal Arborizations. Jour. Comp. Neurology 76: 57-73.
- 1942. Studies of Living Nerves. VIII. Histories of Nerve Endings in Frog Tadpoles Subjected to Various Injurious Treatments. Proc. Amer. Philos. Soc. 85: 168-182.

#### WILLIAM VOGT, Peruvian Guano Administration

Grant No. 481 (1940), \$175. Investigations of microclimates of desert islands off the Peruvian coast.

Observations are being made of the surface temperatures of these islands, in an attempt to learn the controlling factor in the density distributions of nests of the Peruvian white-breasted cormorant (*Phalacrocorax bougainvillii*), and the relationship between these densities, and surface temperatures and wind.

Temperatures are taken, in collaboration with Enrique Avila L., by means of a Taylor Dermatherm, the thermocouples of which are



applied direct to rock or guano, and with thermometers placed on the surface. Wind forces are read with a Fuess anemometer, directly at the surface. Nesting quadrats of 100 m<sup>2</sup>, with different densities, are studied, in comparison with areas never used for nesting by the birds.

While a complete statistical study of the data will not be made until the conclusion of the field work, a preliminary analysis of eight days of measurements, on ten quadrats in Chincha Centro Island, gives a correlation coefficient between wind and surface temperature of  $r = -.53$ , a  $t$  of 5.5, and a  $P$  of considerably less than .01. It is apparent that thermometers applied to the surface tend to give a somewhat high reading, in the presence of bright sunlight and absence of wind, and a somewhat low reading when there is wind.

Whether or not there exists a direct line correlation between nesting densities—which, for a count of 23,882 nests, gave a mean of  $313.9 \pm 3.76$  per 100 m<sup>2</sup>—and wind, is not yet clear, but an association is indicated by temperatures taken with maximum thermometers in three zones: one where the birds nested successfully; a second, where they began to nest but gave up the attempt; and a third, where they have never been known to nest. The first area, during fifty days of the nesting season, had a mean maximum temperature of 34.7° C. with an absolute maximum of 42.5° C.; the second area had a mean maximum of 37.6° C., with an absolute maximum of 44.8° C.; and the third area had a mean maximum of 43° C., with an absolute maximum of 50.1° C.

Occasional temperatures have also been taken, as time permitted, in connection with observations on activity periods of the common coastal lizard (*Tropidurus peruvianus*) but statistical analysis of these will not be made until conclusion of the field work.

TENG-CHIEN YEN, California Academy of Sciences

Grant No. 28—Johnson Fund (1941), \$1,000. Studies of Chinese mollusks preserved in various museums of natural history in the United States, in preparation of a "Manual of Chinese Mollusks."

The Chinese mollusks have arrested the attention of the naturalists abroad since 1758 for more than 180 years. The studies resulting from the collections brought back in early days by sailors, missionaries, travellers and more recently by professional collectors,

are widely scattered in the scientific literature, and such original material, after being studied, has been usually preserved in the cabinets of museums or other institutions of natural history.

In correlating and comparing the molluscan fauna of China, the present writer had in his mind, first of all, to restudy the old collections so far conserved in various museums abroad and secondly to summarize the result of the studies into a set of manuals on Chinese mollusks which is expected to be a kind of foundation work leading this branch of zoology into future advancement.

Since 1936, the writer has been spending his full time in reviewing the Chinese mollusks preserved in museums in Brussels, Paris, Berlin, Vienna, Frankfurt a. M., London; and this work is now continued in this country.

On receipt of the present grant, the work was carried on in the Academy of Natural Sciences in Philadelphia, and also on a new collection from West China made by Mr. Brooke Dolan II, during 1934-35. There are 108 species of land and freshwater gastropods comprised in this collection, among which no fewer than  $\frac{1}{5}$  are found to be new to science including two new genera in the family Enidae.

From late April, the writer spent three weeks in New York State Museum in Albany, examining a part of the type-specimens of Gould's Chinese species described from the North Pacific Expedition which are preserved in that Museum. For the same purpose, he spent the following two weeks in the Museum of Comparative Zoology of Harvard University. Although he did not succeed in discovering any Chinese species of Gould's material there, he was asked to check over their Chinese species of Clausiliidae which are contained in Webb's collection of that Museum. In continuing the work, he visited Washington, D. C., for the collection preserved in the United States National Museum where he stayed till early July and completed his paper on Gould's type-material of Chinese mollusks.

In obtaining a more complete survey of the molluscan collection preserved in various institutions in this country, he travelled from Washington, D. C., to San Francisco and made short visits to the Carnegie Museum in Pittsburgh, the Chicago Academy of Sciences and the Field Museum in Chicago, the Los Angeles Museum of Natural History and Arts, University of California at Los Angeles,

the Museum of Natural History in San Diego and finally to the California Academy of Sciences in San Francisco.

From the middle of August to the end of October, he was engaged in identifying the species of a large molluscan collection from Chekiang of Eastern China in the California Academy of Sciences and has completed a paper on this collection with six new species therein described. He is now proceeding with his work on the "Manual of Chinese Mollusks."

YEN, TENG-CHIEN, 1941. Notes on Chinese Species of Assiminea. *Nautilus* 54: 119-121.

—— 1941. Notes on the Genus *Lagochilus* Blanford, with Special Reference to its Chinese Species. *Nautilus* 55: 40-43.

—— (with PILSBRY, H. A.). Zoological Results of Second Dolan West China Expedition of 1934-35, Mollusks. *Proc. Acad. Nat. Sci. Phila.* (In press.)

—— Notes on Unfigured Type-Specimens of Chinese Mollusks from the North Pacific Expedition. *Proc. Calif. Acad. Sci.* (In press.)

—— Notes on Land and Freshwater Mollusks of Chekiang Province. *Proc. Calif. Acad. Sci.* (In press.)

## BOTANY AND BACTERIOLOGY

HARRY GREGORY ALBAUM, Brooklyn College

Grant No. 507 (1941), \$300. Research on the specific rôle of auxin in plant growth; detailed study of the respiratory metabolism.

I. The growth and metabolism of oat seedlings after seed exposure to oxygen.

When grains of *Avena sativa* are oxygenated during the soaking period, subsequent growth, as measured by coleoptile elongation, is almost completely inhibited as compared to aerated controls. Enzyme assays carried out on embryos of oxygenated plants 30 hours after treatment show little or no change in cytochrome oxidase activity, lowered catalase activity and a lower dehydrogenase activity.

In an attempt to explain the lowered enzyme activity, total nitrogen in embryo and endosperm was assayed in aerated and oxygenated plants. In aerated plants there is an increase in embryo nitrogen at the expense of the endosperm, and this increase is correlated with growth. In oxygenated plants, where little growth has occurred, there is a corresponding decrease in nitrogen transport from the endosperm. Correlated with this failure of nitrogen to move across into the embryo there is a corresponding inhibition in

the development of the catalase and dehydrogenase systems. In the case of catalase, furthermore, it is shown that by 120 hours, in addition to the slowing down in the development of enzyme activity, there is also enzyme destruction or inactivation.

Finally, the inability of nitrogen to move across is related to a lowering in the rate at which protein is being broken down in the endosperm of oxygenated plants, as measured by the production of amino nitrogen. The effect of oxygen is apparently not due to a mechanical washing out of  $\text{CO}_2$ , since nitrogenation of seeds produces no similar growth inhibition.

It is suggested that the oxygen effect may be due at least in part to a decrease in proteolytic activity in the endosperm, which in turn prevents nitrogen from moving from endosperm to embryo, thus preventing the development of enzyme systems, which seem to be essential for growth.

This work was done in collaboration with J. Donnelly and S. Korkes.

## II. The effects of various respiratory stimulants on the growth and metabolism of oat seedlings.

The growth of coleoptiles on intact seedlings is related, at least in part, to the movement of nitrogen from the endosperm to the embryo. This movement may be blocked by stopping proteolytic breakdown as in the case of grain oxygenation during the soaking period (see previous abstract). The experiments reported in this abstract indicate that this essential nitrogen movement may be further interfered with by blocking the mechanism which transports the nitrogen.

Grains of *Avena sativa*, var. Black Norway, were aerated for twenty-four hours in distilled water and then grown in beakers containing various concentrations of sodium fluoride, sodium azide, sodium pyrophosphate, potassium iodoacetate, potassium arsenite, potassium maleate, and potassium malonate. Coleoptile length was used as an index of growth and was measured at various intervals throughout the growth period.

In high concentrations, fluoride (.04 M), azide (.005 M), and pyrophosphate (.05 M) inhibit growth markedly and completely. In lower concentrations, these substances produce an early growth inhibition followed by stimulation which results in a longer coleoptile than the controls. Potassium arsenite in all concentrations

tested (.00001 M-.001 M) produces either no effect or partial to complete inhibition. Potassium iodoacetate (.000005 M-.0001 M) likewise produces either no effect or marked inhibition. That the iodoacetate effect is not similar to the arsenite effect is indicated by the fact that the iodoacetate poisoning can be completely reversed by potassium pyruvate, fumarate, malate and succinate, while the arsenite poisoning cannot be reversed in this manner.

Whereas maleate and malonate poison the oxygen uptake of isolated animal tissues, in intact seedlings they not only fail to poison oxygen uptake, but also produce no growth inhibitions. In fact they act as growth stimulants in a manner similar to pyruvate, fumarate, malate and succinate. This effect is even made more striking by the observation that both maleate and malonate reverse the iodoacetate poisoning in the same way that pyruvate and the four carbon dicarboxylic acids do.

That the effects of maleate and malonate are not simple is shown by the observation that in embryos isolated from endosperms not only is oxygen uptake blocked but growth is inhibited. It appears, therefore, that embryos when they are a part of a growing seedling behave very differently from the same embryos when they are isolated.

Sodium azide and sodium fluoride in the concentrations in which they are effective in producing early inhibition and later stimulation, in addition to blocking oxygen uptake and growth of the embryo during the early inhibitory stages, also slow up nitrogen movement from the endosperm to the embryo. This effect is not upon proteolytic breakdown in the endosperm, but appears to be directly upon a transport mechanism. The same kind of inhibition of this transport mechanism is produced by arsenite. Such a block cannot be reversed by any of the four-carbon dicarboxylic acids. It appears, therefore, that transport of nitrogen depends not only on proteolytic breakdown but upon a special mechanism which requires oxygen and may be poisoned by azide, fluoride and arsenite. This mechanism furthermore is not poisoned by maleate or malonate.

In conclusion, the growth of the oat seedling may be inhibited by interfering with proteolytic breakdown in the endosperm, by blocking nitrogen transport from endosperm to embryo with respiratory poisons, or by interfering with the metabolic processes of the embryo itself. Further experiments aimed at further clarifying the inter-

relations of the systems described to the growth of the whole seedling are in progress.

This work was done in collaboration with S. Kaiser, C. Guttentag and B. Eichel.

BRITTON CHANCE and LESLIE A. CHAMBERS, Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania

Grant No. 27—Johnson Fund (1940), \$5,000. An investigation of biologically significant materials by direct measurement of their dimensions through electron microscopy and the interpretation of their properties as indicated by variations in geometry and density.

An RCA type B electron microscope has been installed at the Johnson Foundation quite recently, its arrival having been delayed by the existing shortage of materials. The instrument is now being used in pursuance of the program proposed in the original application for a research grant.

Immediate emphasis is being placed on those aspects of the program having a relationship to the war effort, notably the study of the viruses of influenza, measles, and poliomyelitis, and of various prophylactic vaccines against these agents of disease. The influenza virus, isolated by ultracentrifugation from the allantoic fluid of infected chick embryos (Chambers and Henle), has been determined by electron microscopy to be about 10.5 mu in diameter. This figure confirms the 11 mu diameter calculated from the sedimentation velocity on the assumption that the particles were spherical, an assumption subsequently justified by the electron micrographs. The virus of influenza was previously supposed to be relatively large, but these studies show it to be one of the smallest pathogenic agents thus far identified.

Preliminary examination of chick allantoic fluids containing the virus of measles indicates that virus particles in this case are also spherical and that their diameter is approximately 15 mu. No previous measurements of the measles virus have been made.

VERNON I. CHEADLE, Rhode Island State College

Grant No. 442 (1940), \$400. Investigations of the vascular system in the Monocotyledoneae.

In addition to the technical work accomplished last year and reported in the 1940 YEAR BOOK (pp. 140-141), a few more plants

were collected and eight hundred permanent slides were made of macerated and sectioned tissues from various parts of the plant in a large number of species. The observations which have been made can be summarized as follows:

1. More detailed work on the occurrence of vessels in the Monocotyledoneae has resulted in a relatively small alteration of conclusions presented in the 1940 YEAR BOOK. The Sparganiaceae and Eriocaulaceae in general, instead of exhibiting vessels only in the roots, have a few primitive vessels throughout the shoot system. Ink injections were made to confirm more detailed observations of sectioned and macerated tissues. A paper on the occurrence of vessels is now practically completed.

2. A study was conducted of some of the factors which affect the form or appearance of the vascular bundle. The bundles were typed and discussed in terms of relative specialization and phylogenetic position. The conclusion reached was that after examination of collateral bundles in cross section it should be reasonably possible to prophesy (1) whether vessels are present and if so the type of perforation plate they probably possess and (2) the degree of specialization of the sieve tubes.

3. In the observations being made of the occurrence of vessels in the Monocotyledoneae, special attention is being paid to the habitat and to the habit of the species examined. That the environment has a definite influence on plant structure has long been recognized.

There is a more or less general relationship between the habitat of plants in the Monocotyledoneae and the occurrence of vessels. The finely dissected or ribbon-like plants of extreme aquatics, for example, lack vessels entirely. In relation to other habitats, however, another factor—the *habit* or form of the plant—is involved in the occurrence of vessels, and complicates the subject. For an illustration, plants of typically bulbous or cormose nature which have been examined never have vessels in the shoot system, although they invariably have such elements in the roots. Similarly, in plants whose habit of growth is similar to that of the *Dracaenas* and *Yuccas*, vessels are lacking in the stems, although they may occur sporadically in the leaves. The greatest variations occur in the plants which have upright or aerial stems, including those which are vine-like.

Studies of various plants occupying the same environment clearly indicate that in the Monocots phylogenetic specialization in the xylem is a factor which should not be ignored when the *immediate* influence of the environment is being studied. In other words, much depends upon the *stage* of phylogenetic modification at which, for example, various groups of plants have entered aquatic habitats.

4. If the above statement be sound, the first problem to be solved in the Monocotyledoneae concerns the recognition of the salient trends in the phylogenetic modification of the xylem, particularly as they pertain to the tracheid and to the vessel. As has already been done in the Dicots, a series demonstrating increasing modification of the conducting cells of the xylem can be constructed in the Monocotyledoneae. Vessels have without much doubt originated from tracheids in the Monocots. As these vessels become modified, the long, oblique end walls shorten to transverse, the numerous perforations are reduced to a single large pore, and the vessel members themselves become shorter and wider. This series is exemplified especially well in many roots of the Monocots. The evidence clearly shows that specialization begins in the last-matured metaxylem and works back into the earliest-matured metaxylem and finally into the protoxylem. The same type of structural modification occurs in the same direction (metaxylem to protoxylem) in other parts of the plant. As was pointed out in the 1940 YEAR BOOK, the root leads in vessel specialization and is followed in turn by the stem and leaf. These conclusions are extremely important phylogenetically because, used with good judgment, they represent a means of solving other problems of structural change which may not be capable of solution within themselves. Furthermore, such information may in a general way be of help in constructing sound explanations concerning certain physiological activities of the plant which are influenced by the functioning of the xylem.

CHEADLE, V. I., 1940 (with WHITFORD, N. B.). Notes on the Occurrence and General Structure of Sieve Tubes in the Monocotyledoneae. (Abstract.) Amer. Jour. Bot. 27 (Suppl.), No. 10.

— 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 140-141.

— 1941 (with WHITFORD, N. B.). Observations on the Phloem in the Monocotyledoneae. I. The Occurrence and Phylogenetic Specialization in Structure of the Sieve Tubes in the Metaphloem. Amer. Jour. Bot. 28: 623-627.



- 1941 (with WHITFORD, N. B.). A Discussion of Some Factors Which Influence the Form of the Vascular Bundle in the Monocotyledonae. (Abstract.) Amer. Jour. Bot. 28 (Suppl.), No. 10.

BARRY COMMONER, Queens College

Grant No. 500 (1940), \$400. Investigations on the growth mechanisms in plants.

Experiments designed to elucidate the mechanism of the effect of indole-3-acetic acid (auxin) on the enlargement of plant cells were carried out. This was done as part of the project of investigating the relation between the plant growth processes and the oxidative reactions which are connected with them. The present experiments are concerned with testing the theory that active osmotic absorption of water is the driving force in the enlargement of plant cells.

Thin slices of potato tuber were used in this work. The exchange of water between the tissue and the solution in which it was immersed was determined by repeated weighings of the slices. The concentration of sucrose solution in which almost no water exchange occurred was first determined. Using this solution as a base, the effect of adding various amounts of indole-3-acetic acid in the presence of varying concentrations of fumaric, malic and succinic acids was observed. It was found that in the presence of  $10^{-4}$  M. K fumarate the addition of 10–20 mgm. per liter of auxin caused the slices to absorb from the “isotonic” sucrose solution (determined as noted above) enough water to produce an increase of 83 per cent in the wet weight of the tissue over the course of two days (as compared with the controls in zero auxin). In this concentration of fumarate, the effect of varying amounts of auxin was typical of this hormone’s influence on growth processes. The effect rises to a maximum at about 10 mgm. per liter and drops off sharply to negative effects as the concentration is increased. The other acids produced similar, but weaker effects. These data showed that the action of indole-3-acetic acid in causing water absorption from “isotonic” sucrose solutions is closely related to the presence of the four-carbon dicarboxylic acids which are known to be hydrogen carriers in cellular respiration. This work was done with the assistance of Mr. Seymour Fogel.

The question next approached was this: Does indole-3-acetic acid influence the solute content of the cell sap and thereby affect

water absorption and cell enlargement? With the collaboration of Dr. Daniel Mazia the following experiments were carried out.

Since it seemed likely that any increase in sap solute would be due to electrolytes, the relation between auxin and salt and water absorption by potato slices was investigated. Potato slices were prepared and vigorously aerated in solutions containing .001 M. KCl and varying concentrations of auxin. Salt absorption was followed for a period of eight days by determining the electrolytic conductivity of the external solutions. Wet weight was also followed in order to determine the course of water absorption. It was found that both salt and water absorption was affected by auxin concentration in the manner typical of all growth effects. The parallelism between the curves for salt and water absorption was striking. Other experiments showed that the positive absorption of salt was always paralleled by water absorption. It was also found that iodoacetic acid, which is known to inhibit the oxidative activities of the four-carbon dicarboxylic acids, causes the cessation of this absorption process.

These data seem to indicate that the salt absorption mechanism of potato cells is affected by auxin and the four carbon acids in the manner in which these substances influence growth processes. It is also indicated that absorption of salt is at least in part the driving force for the uptake of water and the consequent cell enlargement.

A preliminary report of these experiments is contained in a paper being submitted for publication in *Science*. A complete paper is in preparation.

JOHN N. COUCH, University of North Carolina

Grant No. 562 (1941), \$1,000. Studies on lower fungi with particular reference to sex and nutrition.

In collaboration with Dr. Alma J. Whiffen, a new type of life cycle has been demonstrated in the genus *Blastocladiella*. A new species isolated from soil in Texas and growing now in unifungal culture lacks the typical zoosporangial stage, but forms thick-walled, spherical, orange-colored resting bodies, which, after maturity, may be brought to germination. When this happens, a large mass of unflagellated zoospores emerge and, instead of swimming, encyst in an irregular heap. After remaining quiet for

about an hour, the contents of each cyst divide into four unflagellated gametes which emerge and immediately fuse in pairs to form biflagellated zygotes. After swimming for a few minutes or several hours the zygotes come to rest and germinate to form resting bodies. The life history of this species suggests a close parallel to the cystogenes group of Allomyces, except that in the latter no fusion occurs between the motile cells emerging from the cysts.

In addition, two new species with life cycles as in *B. simplex* are being studied in pure culture. These three species form zoosporangia and resting bodies apparently without sexual fusions and thus represent a second type of life cycle. This group corresponds to the *Brachyallomyces* group.

ARTHÈME DUTILLY, Catholic University of America

Grants No. 461 (1940), \$600, and No. 560 (1941), \$600. (a) To complete collections of North American Arctic flora. (b) To preserve by photography the linguistic material, such as manuscript dictionaries, grammars, etc., accumulated by missionaries along the Mackenzie River.

Continuing studies and collecting in the region I have designated as the "Habitat of the Eskimos," I traversed more than 8,000 miles this past summer, thus increasing the 75,000 miles already travelled in the past years (1933-41) to 83,000 miles in the Arctic (by schooner, motor-boats, steamships and foot travel). Eighteen additional Arctic stations have been explored, making a total of 193, where I collected and made studies.

I brought back for the "Langlois Herbarium" and the "Arctic Institute" at the Catholic University of America:

- a) about 2,000 sheets of arctic plants from the shores of the Hudson Bay, Hudson Strait, Baffin Island, Somerset Island and Greenland,
- b) about 40 different rock and mineral specimens, soon to be studied and determined by specialists in the United States Geological Survey,
- c) eggs of migrating and Arctic birds already identified by H. G. Deignan (Assistant Curator, Birds, U. S. National Museum): *Branta canadensis leucopareia* (900), *Somateria mollissima borealis* (901; 903; 904), *Somateria spectabilis* (902), *Larus hyper-*

- boreus (905), *Cepplus grylle mandti* (906; 907), *Gavia stellata* (911?; 912; 913), *Gavia arctica pacifica* (911?), *Lagopus lagopus* subsp. or *Lagopus rupestris* subsp. (914-918), *Sterna paradisaea* (919; 920; 921),
- d) 18 bottles of plants parts (in killing fluids), leaves, scapes, spikes, roots and peduncles of Cyperaceae, mostly for Morphological studies by Dr. J. O'Brien and Dr. Hugh T. O'Neill, C.U.A.,
  - e) 14 bottles of root tips of Cyperaceae, collected between 1 and 3 p.m., for Cytological (chromosome-counts) studies by Dr. D. Brangart, C.U.A.,
  - f) 9 bottles of parasites of dogs, salmon truits, etc., to be studied by Dr. Von Brand, parasitologist, C.U.A., and a few bottles of crustaceae and mollusca to be studied by Dr. E. Reinhard and other specialists,
  - g) 7 bottles of Eskimo's faeces to be studied for content of parasites by Dr. Von Brand, C.U.A.,
  - h) 200 feet of colored moving picture film showing arctic plants, their habitat, etc.,
  - i) 120 slides (Kodachromes) illustrating plants, Eskimo life, arctic geology and geography,
  - j) additional data and material for the following three publications in preparation: a substantial part of the "Flora Arctica" (Family, Cyperaceae), "How to Maintain Health in the Arctic," "Bibliography of the Arctic." It is hoped to complete one or both of the last mentioned publications in the interest of National Defense. The next to last may serve as a manual for our people stationed in Greenland, Iceland and Alaska.

The largest part of the specimens of plants collected will be distributed on exchange with United States National Herbarium, Bureau of Plant Industry, United States Department of Agriculture, the Ottawa National Museum, Universitet Museum in Copenhagen, Riksmuseet in Stockholm, Dr. Schischkin of Petrograd, and about a dozen other European institutions with Arctic Collections.

The specimens of plants, I collected last summer in the Arctic, represent 32 families, 73 genera and 172 species.

The only family already finished, identified by Dr. Carlton Ball (United States Dept. of Agriculture), is *Salix*, represented by 15 species and varieties. Follows the list:

|                                         | Arsuk, Greenland<br>61° 12' N., 48° 11' W. | Chesterfield Inlet, II. B. | Churchill, Man. | Clyde River, Baffin Isl.<br>70° 20' N., 68° 50' W. | Fort Ross, Somerset I.<br>72° N., 94° W. | Hebron, Labrador<br>58° 15' N., 62° 37' W. | Iqaluit, Hudson B.<br>63° N., 90° W. | Ivigtut, Greenland<br>61° 12' N., 48° 14' W. | Lake Harbour, Baffin Isl.<br>62° 50' N., 69° 52' W. | Pangnirtung, Baffin Isl.<br>66° 8' N., 65° 25' W. | Pond's Inlet, Baffin I. | Port Burwell, Hudson Str.<br>60° 25' N., 64° 52' W. | Resolution Isl. N.W.T.<br>61° 18' N., 64° 53' W. |
|-----------------------------------------|--------------------------------------------|----------------------------|-----------------|----------------------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------|----------------------------------------------|-----------------------------------------------------|---------------------------------------------------|-------------------------|-----------------------------------------------------|--------------------------------------------------|
| <b>SALIX</b>                            |                                            |                            |                 |                                                    |                                          |                                            |                                      |                                              |                                                     |                                                   |                         |                                                     |                                                  |
| alexensis obovalifolia Ball             |                                            | +                          |                 |                                                    |                                          | +                                          |                                      |                                              |                                                     |                                                   |                         |                                                     |                                                  |
| anglorum Cham                           |                                            | +                          |                 | +                                                  | +                                        | +                                          |                                      |                                              |                                                     |                                                   | +                       |                                                     | +                                                |
| anglorum antiplasta Schn.               |                                            | +                          |                 |                                                    |                                          | +                                          |                                      |                                              |                                                     | +                                                 |                         |                                                     | +                                                |
| anglorum kopophylla Schn.               |                                            |                            |                 |                                                    |                                          |                                            |                                      |                                              |                                                     |                                                   |                         |                                                     | +                                                |
| arctophila Ckll.                        |                                            | +                          | +               |                                                    |                                          | +                                          |                                      |                                              |                                                     | +                                                 |                         | +                                                   |                                                  |
| brachycarpa Nutt.                       |                                            | +                          | +               |                                                    |                                          |                                            |                                      |                                              | +                                                   |                                                   |                         |                                                     |                                                  |
| brachycarpa antimima (Schn.) Raup       |                                            | +                          |                 |                                                    |                                          | +                                          |                                      |                                              | +                                                   |                                                   |                         | +                                                   |                                                  |
| calicicola Fern. Wieg.                  |                                            |                            | +               |                                                    |                                          |                                            |                                      |                                              | +                                                   |                                                   |                         | +                                                   |                                                  |
| cordifolia callicarpeae (Trautv.) Fern. |                                            |                            |                 |                                                    |                                          |                                            |                                      | +                                            | +                                                   | +                                                 |                         |                                                     |                                                  |
| cordifolia intonsa Fern.                | +                                          |                            |                 |                                                    |                                          |                                            |                                      | +                                            |                                                     |                                                   |                         | +                                                   |                                                  |
| cordifolia typica Fern.                 |                                            |                            |                 |                                                    |                                          |                                            |                                      |                                              |                                                     |                                                   |                         | +                                                   |                                                  |
| fullertonensis C. Schn.                 |                                            |                            |                 |                                                    |                                          | +                                          |                                      |                                              |                                                     |                                                   |                         |                                                     |                                                  |
| herbacea L.                             |                                            | +                          |                 | +                                                  | +                                        | +                                          |                                      | +                                            | +                                                   | +                                                 | +                       |                                                     | +                                                |
| peasei Fern.                            |                                            |                            |                 |                                                    |                                          | +                                          |                                      |                                              |                                                     |                                                   |                         |                                                     |                                                  |
| reticulata L.                           |                                            | +                          |                 |                                                    |                                          | +                                          |                                      | +                                            | +                                                   |                                                   | +                       | +                                                   | +                                                |
| uva-ursi Pursh                          |                                            |                            |                 |                                                    |                                          |                                            |                                      | +                                            | +                                                   |                                                   |                         | +                                                   |                                                  |

DUTILLY, ARTHÈME, 1941. List of 163 Different Mosses, annotated by Dr. Steere of University of Michigan. *Scolasticat N.-D., Richelieu, P. Q., Canada.*

— 1941. List of 76 Different Lichens, annotated by B. Lynge, *Farmasøitisk Institut, Oslo. Scolasticat N.-D., Richelieu, P. Q., Canada.*

— 1941. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1940: 160-161.*

— 1941. Research and Oblate Missions in the Canadian Arctic. *Science Counselor VII, 1: 3, 4, 21.*

DUMAN, MAX, 1941. The Genus *Carex* in Eastern Arctic Canada. *Cath. Univ. Amer. Press, 86 pp.*

MEANEY, SISTER MARY MARTHA, 1941. A Key to the Genus *Antennaria* in Arctic America. 18 pp. (Unpublished.)

O'NEILL, HUGH T., 1941 (with DUMAN, MAX). New Species of *Carex* (C. Dutillyi) and Notes on this Genus in Arctic America. *Rhodora 43: 413-425.*

CARROLL WALTER GRANT, Brooklyn College

Grant No. 555 (1911), \$500. Studies in marine microbiology at the Scripps Institution of Oceanography, University of California, La Jolla.

A general survey of the occurrence and importance of bacteria in the sea is being made with special reference to those exhibiting the distinctive features of agar liquefaction, photogenesis, chitin digestion, nitrogen fixation, hydrocarbon utilization and thigmotropism. A large number of bacteria which have been isolated from sea water and marine mud are being made the subject of investigation.

In collaboration with Dr. Claude E. ZoBell, studies have been made on the minimum nutritive requirements of marine bacteria. Sea water and added organic nutrients, ranging from one to one hundred milligrams per liter, have been used. Evidence has been produced in growth, total counts and oxygen utilization to show that quantities of nutrient material as low as that occurring either in natural sea water or only one milligram of glucose or peptone per liter support active bacterial multiplication. The rate of bacterial multiplication and respiration is more or less directly proportional to the concentration of organic matter. Concentrations of glucose ranging from one to five milligrams per liter are utilized quantitatively.

Several species of chitinoclastic bacteria have been isolated from sea water and marine sediments. Some of these exhibit striking coloration and marked thigmotropism. Their morphological, cultural and physiological characteristics are being investigated. The pigments produced by these organisms are being made the subject of special study in collaboration with Dr. Denis L. Fox, biochemist at the Scripps Institution of Oceanography.

Nonsymbiotic nitrogen-fixing bacteria have been isolated from sea water. Daily samples collected from the end of the Scripps Institution pier reveal the presence of 1 to 87 bacteria per cc. which multiply in a nitrogen-free synthetic sea water medium prepared with mannitol. This number may be contrasted with a heterotrophic bacterial population of 50 to 5,000 organisms per cc. which grow on a nutrient medium containing available nitrogen. Several bacteria are found in coastal waters which will grow in fresh water nitrogen-free mannitol medium. While it is possible

that these organisms may be of terrestrial origin, it is significant that appreciable numbers of nitrogen-fixing bacteria have been found associated with kelp, considerable distances offshore. It is believed that the carbohydrate requirements of the nitrogen-fixing bacteria may be obtained from the disintegration of kelp. Some of the bacteria closely resemble the genus *Azotobacter*.

An effort is being made to isolate various kinds of bacteria capable of oxidizing different hydrocarbons. Such bacteria may play an important role in the accumulation of petroleum and may also influence the diagenesis of marine sediments.

LADEMA MARY LANGDON, Goucher College

Grant No. 492 (1940), \$400. Studies in the comparative morphology and taxonomy of the Fagaceae.

Certain features of the flower and inflorescence morphology of species of six of the existing genera of the Fagaceae are here presented as part of a phylogenetic study in progress embracing both the gametophytic and the sporophytic characters of the beech-oak branch of the Fagales. Much confusion exists in the determination of species and even genera in this family, as well as the persistence of the vexing problem of the ancestry of a group regarded by many phylogenists as among the most primitive of angiosperms, and by others as highly specialized.

The conclusions reported are based upon a flowering and fruiting series of species of *Quercus*, *Fagus*, *Castanea*, and *Castanopsis*, furnished chiefly by stations of the United States Department of Agriculture; these collections supplemented by herbarium material, especially of *Lithocarpus* and *Nothofagus*.

The flowers of the Fagaceae are found to exhibit a great variety of arrangements, which are, notwithstanding, subject to organization into three fairly well defined groups or lines, representing a possible evolutionary sequence. (1) Flowers in simple 1-several flowered dichasia in the axils of the leaves; the pistillate cupule-enclosed and either sessile or on short peduncles, the staminate in small capitate clusters (species of *Fagus* and *Nothofagus*). In certain species of *Nothofagus*, the florets are borne on special flowering branchlets near the tips of densely leafy axes. Mixed inflorescences are of infrequent occurrence. (2) Flowers generally in racemously arranged cymose inflorescences; these flowering

spikes occurring in branched axillary panicles combining staminate and androgynous aments, or are borne singly or in groups of 2-3 in the axils of upper leaves, the pistillate or androgynous usually uppermost. Variability appears in the arrangement of staminate and pistillate florets within the androgynous aments, as also the distribution of staminate and androgynous aments in different species of the same genus (in order of advancing complexity—species of *Lithocarpus*, *Castanopsis*, and *Castanea*). (3) Flowers solitary or in groups of 2-3; the staminate in slender drooping catkins borne in the scale or lower foliage leaf axils, the pistillate cupule-inclosed and erect in the axils of the upper foliage leaves. Mixed inflorescences unknown (species of *Quercus*).

Reductions and variations in the usual floral pattern occur throughout the series, especially in the two latter groups, but as evidence of specialization, are not so notable as in the *Betulaceae* and *Corylaceae*.

Flowering and fruiting features, especially noteworthy, are presented by certain species of the genus *Nothofagus*: (1) fruits are triangular and conspicuously winged, the three nutlets inclosed by a four-valved involucre, the valves conspicuously adorned with gland-bearing scales resembling those borne by the cupule segments of the seeds of *Lyginopteris*; (2) the mode of fructification of the New Zealand species *N. Moorei* and *N. Menziesii* bears a striking resemblance to that of certain of the pteridosperms, especially *Emplectopteris triangularis*, save that cupule-inclosed fruits (not seeds) are borne on a pinnatifid leafy branch system rather than on pinnately branching fronds.

Attention has previously been directed to the persistence in the *Fagacean* series of inner and outer fleshy regions alternating with a stony layer in the seed-incasing body (including ovary wall and involucreal structures) suggesting a pattern well defined in the gymnosperms, even to the cupule-inclosed seeds of the pteridosperms.

CARL C. LINDEGREN, University of Southern California

Grant No. 455 (1940), \$500. To analyse bacteria genetically with a view to listing the different genes and describing their various effects.

The minute, uninucleate, haploid spermatia of *Neurospora crassa* were treated by ultra-violet and x-rays and single treated spermatia were planted separately in small culture tubes. The cul-



tures which grew, together with an adequate number of untreated controls, were critically studied for phenotypic variation as compared to normal and for stability on serial subculture. In addition, the variants, the non-variants, and a number of control cultures were mated to the ordinary wild-type form. Genes differentiating many of the variants were segregated at meiosis. This was proof of the fact that the induced mutations were true mutations.

X-ray treatments of about 20,000 r units were given. About 50 per cent of the spermatia survived, compared to over 80 per cent survivors in the controls. About  $\frac{1}{4}$  of the x-ray treated survivors were mutants; 21 variants were obtained.

Spermatia were also treated with nearly monochromatic ultra-violet rays of about 2,537 Å. Less than 1 per cent of the spermatia survived when treatments of about 1,500 ergs per square mm. were given. Considerably more than 80 per cent of the controls germinated. The mutation rate was about 8 per cent under these conditions and 32 variants were obtained.

These results support the current view that the types of variation induced by x-rays differ from those induced by ultra-violet. A list of the classified variants follows:

| Type of Variation     | Ultra-violet | X-rays |
|-----------------------|--------------|--------|
| Gene Mutations        | 20           | 11     |
| Diminished fertility  | 0            | 9      |
| Degenerate phenotypes | 12           | 1      |

The ultra-violet mutants were all fully fertile. Genetic analysis of one of the cases of diminished fertility induced by x-rays indicated that it was due to an inversion.

The degenerate phenotypes were phenotypically unstable and did not yield to genetic analysis.

LINDEGREN, CARL C., 1941 (with LINDEGREN, GERTUDE). X-ray and Ultra-violet Induced Mutations in *Neurospora*. I. X-ray Mutations. *Jour. Heredity* 32: 404-413.

——— 1941. X-ray and Ultra-violet Induced Mutations in *Neurospora*. II. Ultra-violet Mutations. *Jour. Heredity* 33: 435-440.

——— 1941. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1940*: 210-211.

D. T. MacDOUGAL, Carmel, California, and J. DUFRENOY,  
State University, Louisiana

Grants No. 429 (1940), \$1,000, and No. 556 (1941), \$300. Mechanism of mycorrhizae which make possible disjunctive growth of roots and trunks of pine trees.

Extension of observations on the pine mycorrhiza confirms the fact that the main period of elongation and of thickening by cambial action of pine roots is coincidental with the vigorous growth of the hyphae of the soil fungi including the symbiotic species and is in the cooler winter season and not at the time of most rapid elongation of shoots and most vigorous cambial action in trunks. Identifications of nearly a score of species of fleshy fungi native to the habitat of the Monterey pine has been made. It is not possible to determine what two or three species may furnish symbiotic hyphae.

Cultures of isolated segments of mycorrhizal pine roots have been continued. The relative independence of these mycorrhizal units rests essentially upon the comparatively enormous absorbing surface of the network of hyphae ramifying in the soil, and upon the capacity of the cortical cells of the root for building protoplasmic material and synthesizing carbohydrates from substances made available by the fungus. It is apparent that these cultures might be continued indefinitely by transfer of the cultures to fresh preparations of soils rich in humus.

As a result of a technique developed in this research it is found that the hyphae yield a molybdenum blue indicative of phosphoric complexes when treated with a molybdenum reagent, and an indophenol blue after treatment with quinone-chloro-imide a reaction for pyridoxin, a theoretical source of the carbohydrates formed in the roots. Details of the tests can not be given in this brief report, nor without the use of colored illustrations.

Correlation between cytological structure and distribution of phosphoric complexes (of the Vitamin B group) in minutest detail has been established.

Attempt has been made to interpret symbiosis as occurring in mycorrhizae in terms of cell-respiration, whether balanced by the interplay of oxidases and dehydrogenases, or "decompensated" following dispersion of the dehydrogenases, and correlatively un-

checked activity of oxidases. It is in this field of activity that the difference between the symbiotic and possible parasitic action of the fungus is to be sought.

Guillermund's conclusions as to the difference between mitochondria and plastids are confirmed. Mitochondria are in the form of slender blue rods in the molybdenum test, while plastids are heavier bodies of irregular form. Further treatment with acid fuchsin results in the development of a bright red color in the mitochondria assumedly due to a heavy coating of lipids, while the plastids take on a purplish hue. Starch granules in all stages of development in the plastids may be seen in these tests. Mitochondria, which are peculiar to plant cells, supposedly play a role in the building up of cellulose, a characteristic plant substance.

The extension of our observations on mycorrhizae has uncovered cytological features and metabolic mechanisms which make possible an advanced interpretation of the nature of the symbiosis between fungi and roots, an indispensable cooperation for trees and a nutritive relation of vital importance to the greater majority of seed-plants. A comprehensive presentation will be made as soon as possible.

MACDOUGAL, D. T., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 214-217.

STUART MCGREGOR PADY, Ottawa University, Kansas

Grant No. 513 (1941), \$600. To investigate the controversial problem of whether there are two species of *Melampsorella*, the witches' broom rust disease, on *Abies* (fir) and *Picea* (spruce).

Further information on the problem of whether or not there are two species of *Melampsorella*, the witches' broom rust disease on spruce (*Picea*) and fir (*Abies*), was obtained during the summer of 1941 through an investigation of the distribution of the disease and also by preliminary infection studies on its alternate hosts.

A large number of the National Forests and National Parks were visited, 70 collections and over 150 detailed observations were made, and many photographs taken. The rust was collected in the following National Forests: Uintah, Wasatch and Powell, in Utah; Kaibab in Arizona; Mt. Hood in Oregon; Teton, Wyoming, and Medicine Bow in Wyoming; Harney and Black Hills in South

Dakota; and in the National Parks of Grand Canyon, Sequoia, Yosemite, Crater Lake, Mt. Rainier, Glacier, Yellowstone and Grand Tetons. The results of these observations and collections, which are being summarized and tabulated, and which will be published in detail later, yield further evidence for the existence of two species. The distribution patterns of the two rusts are entirely different, although the two hosts grow under almost identical conditions. In practically every area visited one or the other rust species would be found to be dominant, in some areas only one species being present.

It was discovered also that in certain areas in the Rocky Mountain states the disease is more widespread and much more serious than generally realized. In some localities, for example in certain areas in Yellowstone National Park and in the Medicine Bow National Forest, the disease occurs in epidemic proportions and constitutes a serious problem. Many diseased trees were found in which the tops were dead, and others which had been prematurely killed. The disease shortens the life of the tree and, if the infections are extremely heavy, may stunt its growth and even kill it.

Considerable misunderstanding was found to exist with regard to this disease and mistletoe, due to the fact that each produces witches' brooms on the same hosts which are superficially similar. As a result, *Melampsorella* has often been overlooked or incorrectly classified. In several localities where it was believed to occur, only the mistletoe brooms could be found; in a few cases the forest was said to be free from the disease, yet the rust was present in abundance.

Successful infection studies were carried on with the cooperation of the Botany Department of the University of Wyoming, in the vicinity of the Summer Camp in the Snowy Range Mountains. Aeciospores were inoculated from both *Picea* and *Abies* to several species of *Stellaria*. Infection was readily obtained with the aeciospores from *Abies* but with some difficulty with the aeciospores from *Picea*. The infected *Stellaria* will be used for two purposes: first, for a comparative study of the uredo and telial stages, and secondly, for cross-inoculations back to *Picea* and *Abies*. These latter infection experiments, if successful, would be conclusive proof of whether or not there are two distinct species of *Melampsorella*.

J. E. POTZGER, Butler University

Grant No. 531 (1940), \$150. Influence of location of borings in bogs on completeness of pollen profiles; pollen records from sediments of four lakes in Anoka County, Minnesota: a study on methods of sampling. (This work has been carried out with the cooperation of Ira T. Wilson, of Heidelberg College, Tiffin, Ohio.)

The present work is one phase of a study on methods of securing samples for pollen analyses, begun by the authors two years ago. It is a well known fact that the borers customarily used to secure peat samples do not operate in sandy layers. The authors know of no place where sand was so prominent a factor in early lake deposits as in the Anoka Sand Plain region of Minnesota, and where one could determine the extent of early pollen records in these sandy deposits. Since the Wilson sampler can take samples in sandy sediments, the study was undertaken in this Minnesota county. Previous bog studies in the same county gave excellent opportunity to make analytical comparisons. In the profiles from the bogs, pine usually appeared very prominent in the top foot-levels, while the vegetation of today is strikingly oak. Since lake sediments made records of pollen up to the present, this study promised an answer to this apparent inconsistency. Not all lakes studied (Crooked, Ham, Island, Tamarack) were alike in the depth of sediments made up of fine sand, but all had some of the early deposits made up of sand, reaching a maximum of seven feet in Island Lake. All sediments constituted of fine sand had a good representation of pollen, mainly spruce and fir. The levels constituting the upper half of sediments in all four lakes showed a decided decline of pine and prominent increase in oak, indicating that bogs in the regions were closed before these vegetational changes took place. Sediments in lakes total on an average thirty-five feet. Samples collected with the sleeve-type borer recorded spruce-fir dominance while on an average of one-half to three feet of sediments were laid down; sediments taken from four lakes and one bog with the Wilson borer showed spruce-fir dominance for a time represented by five to seven feet of sediment. While from collections of peat made with the sleeve-type borer in regions where sand constitutes much of the soil adjacent to bodies of water the pollen spectrum can record all vegetational changes of the past, the relative importance and duration of the spruce-fir dominance cannot be obtained from such collections of sediments.

A report on this work was on the program of the Ecological Society of America at their meeting in Dallas, Texas, December 29-31, 1941.

The authors discovered in a previous study (Ms. 1941) that the generally accepted theory of centripetal filling of lakes to bog stage is not correct, but found, on the basis of numerous line transects in a number of lakes and bogs, that filling begins in the deepest depressions of a lake, and encroachment by a bog mat does not occur until late in the filling process. If borings in sediments of bogs and lakes are not made in the deepest parts of the depression the entire spruce-fir period, or even later successional stages, may be missing in the pollen profile. This has led to numerous erroneous interpretations of the vegetational history, length of time during which a given vegetation type dominated, or of the initiation of the lake itself. Checking of borings made in bogs of Indiana, Wisconsin, and Minnesota, where incomplete profiles had been reported, showed that absence of spruce-fir dominance was due in every case to the defect in the location of the borings. In two bogs where spruce-fir had been reported wanting, the later boring showed these genera in control for a period of time during which more than seven feet of sediments accumulated. The paper points out the importance of making borings in the deepest part of a basin if complete pollen profiles are desired, and urges avoidance of bogs of the valley type, or where ponds still occupy the central portion.

J. E. WEAVER, University of Nebraska

Grants No. 283 (1938), \$450; No. 380 (1939), \$600; and No. 489 (1940), \$600. Studies on degeneration of midwestern grassland and the processes of recovery.

An outstanding change resulting from the long period of drought has been the shifting of grass dominants in true prairie from the more mesic to the most xeric. Western wheat grass (*Agropyron smithii*, Rydb.), which was formerly of little importance in the eastern third of Kansas and Nebraska, has invaded hundreds of square miles of drought-stricken prairies and native pastures. This perennial, sod-forming grass migrates rapidly by

means of long, slender, much branched rhizomes. This is in sharp contrast with its bunch forming competitors. The early luxuriant growth, when water is available, results in greatly reducing the amount of soil moisture for use by other species, most of which begin development four or more weeks later. Lack of much debris under wheat grass results in high runoff and slow infiltration of water, thus further decreasing water content of soil.

Competition for water has resulted in great dwarfing and often in wilting and death of most other prairie grasses and forbs. Side-oats grama (*Bouteloua curtipendula*) competes with wheat grass on equal terms only when a dry, early spring delays growth of the invader. Blue grama (*B. gracilis*), a very xeric but low yielding grass, is more resistant to drought and sometimes replaces the wheat grass. Wheat grass is of much less value for grazing or hay than the bluestems (*Andropogon*) and other species it has replaced. The large area of true prairie and native pastures now dominated by western wheat grass and the harmful effects of its severe competition for water present a problem of much scientific interest and great economic importance.

Throughout midwestern grasslands, brief periods with rainfall have repeatedly resulted in germination of seed but have been followed so quickly by drought that nearly all seedlings died. The drought has now continued with only slight interruptions for eight years (to 1941) and it appeared that the amount of seed remaining was small. In collaboration with Dr. I. M. Mueller, square-foot samples of surface soil were collected in early spring from 49 ranges and prairies in Nebraska, Kansas, and Colorado, and viable seed germinated. During June, numbers and kinds of seedling grasses were determined in each of 25 square-foot areas in each range or prairie. Viable seeds of native perennial forage grasses were present in such small numbers (26 per square foot) as to be of limited value, when seedling hazards are considered, in restoration of the vegetation. Average distribution of perennial grass seedlings on the ranges and prairies was 4.3 per square foot; in mixed prairie alone, 2.4 per unit area. Even if all seedlings (exclusive of the stoloniferous buffalo grass (*Buchloe dactyloides*) which were few) had survived and made a maximum growth in mixed prairie, they would have increased the cover less than 2 per cent. Since 1941 was a year of high precipitation, it may be concluded that several years of good seed production and development

of seedlings into mature grasses are necessary for the restoration of midwestern ranges.

In collaboration with Dr. F. W. Albertson, studies on water content of soil and native plant production at 12 permanent grassland stations in Iowa, Nebraska, and Kansas have been continued during a second year. Since 1939 was a year of great drought at the 9 most westerly stations and 1940 one of high precipitation, the value of the study has been greatly enhanced. Relative production on ranges near the dust bowl in Kansas, which had previously been ungrazed, lightly grazed, heavily grazed, or dust covered, has also been continued a second year. The value of judicious grazing is thus being determined.

A continued decrease in the population of forbs has been recorded over a period of six years. In the short-grass plains they were reduced to a very few relicts. Both number of species and individuals now begin to show small gains with the return of normal or above normal precipitation.

A resurvey of root depth was completed in both true and mixed prairie with the moistening of deeper soil which has been dry seven or eight years. In a few areas examined, the normal root depth of most species has been maintained. In other extensive areas all the deeper roots except those of a few relict forbs have died and the present depth is limited to the depth of penetration of water from current precipitation, about 2 to 2.5 feet. In collaboration with Dr. Albertson, it has been found that the present depth of root penetration over much of the mixed prairie in Kansas and Colorado is only 1 to 1.5 feet. Before the drought it was 3 to 4.5 feet.

Changes in plant population at the several prairie stations have been followed since the beginning of the drought. Certain grasslands, mapped in 1936-37, have shown much greater stability than others. A common sequence of stages in true prairie that has been most damaged has been (1) bluestems, (2) ruderals and prairie relicts, (3) side-oats grama and western wheat grass, (4) western wheat grass and blue grama, all stages being accompanied by a steady decrease in perennial forbs. The short-grass ranges have improved but little since the early years of drought except during 1941. Changes have been followed by a widely spread series of permanent quadrats. More than one hundred of these



have been charted near the dust bowl alone for nine consecutive years. Marked improvement in the vegetation has occurred the past summer in response to high rainfall.

- WEAVER, J. E., 1940-41. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 303-305; for 1940: 269-271.
- 1940 (with ALBERTSON, F. W.). Deterioration of Grassland from Stability to Denudation with Decrease in Soil Moisture. Bot. Gaz. 101: 598-624.
- 1940 (with ALBERTSON, F. W.). Deterioration of Midwestern Ranges. Ecology 21: 216-236.
- 1940 (with ROBERTSON, J. H., and FOWLER, R. L.). Changes in True-Prairie Vegetation During Drought as Determined by List Quadrats. Ecology 21: 357-362.
- 1942. Competition of Western Wheat Grass with Relict Vegetation of Prairie. Amer. Jour. Bot. 29. (In press.)
- 1942 (with ALBERTSON, F. W.). History of the Native Vegetation of Western Kansas during Seven Years of Continuous Drought. Ecological Mono. 12: 23-51.
- 1942 (with MUELLER, I. M.). Role of Seedlings in Recovery of Mid-western Ranges from Drought. Ecology 23. (In press.)

EDGAR T. WHERRY, University of Pennsylvania

Grant No. 403 (1940), \$500. Preparation of a monograph on the genus Phlox.

The data collected in the course of the field trip described in last year's report have been partially worked up. There being need for detailed information on the genus Phlox by workers on the flora of individual states, publication is being started on the state basis. Prior to the receipt of the grant the Phloxes of Oregon had been treated. Those of Arizona were next taken up, and the results of study of that state are to appear in a Flora being published by the United States Department of Agriculture. Idaho was then investigated, and found to have a remarkable representation of the genus: 16 species of which 7 are endemic in this and adjacent portions of bordering states. One species and three subspecies were recognized as new to science, and numerous nomenclatorial-taxonomic changes made.

In the course of the trip primarily devoted to the study of Phlox several interesting occurrences of other plants were discovered, and a report on one of these, concerning ferns in Arizona, has also been published.

- WHERRY, EDGAR T., 1941. *Asplenium Adiantum-nigrum* in Arizona. *Amer. Fern Jour.* 31: 97-100.
- 1941. The Phloxes of Idaho. *Notulae Naturae, Acad. Nat. Sci. Phila.* No. 87: 1-15.
- 1941. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1940*: 274.

## PSYCHOLOGY

LOUIS D. GOODFELLOW, Northwestern University

Grant No. 460 (1940), \$360. A statistical technique for controlling the effects of certain subjective factors on psychological data.

Between the traditionally conceived fields of statistics and experimentation an important source of error has appeared, most clearly illustrated in research on extra-sensory perception.<sup>1</sup>

This project<sup>2</sup> consists of a statistical analysis of already existing data in an effort to quantitate certain subjective factors presumed to account for the variance between an individual's guesses and the normal probability curve.

Analyses have been made for several types of data, namely, true-false examinations each consisting of identical questions given under different instructions, a vocabulary test, psychophysical judgments, and a coin tossing experiment. The results to date indicate that the problem is much more complicated than anticipated. In each type of data very large extra-chance factors (other than knowledge) can be seen, but these factors appear to be different in each situation. No single formula applies to all type of data.

The most significant fact uncovered is that the mental-set created by the instructions seems to be the determining factor. The inter-correlations of the tests given under similar instructions, namely, the coin tossing, psychophysical, and telepathy data are high (.87 and above); whereas the inter-correlations found among the other tests are low (.39 and below). This means that the number of unknown factors is increased, and therefore it is impossible to follow out the planned procedure of determining the value of one of the factors from each test and solving them simultaneously for one comprehensive formula.

<sup>1</sup> Goodfellow, L. D., 1938. A Psychological Interpretation of the Results of the Zenith Radio Experiments in Telepathy. *Jour. Exp. Psych.* 23: 601-632.

<sup>2</sup> Goodfellow, L. D., 1940. The Human Element in Probability. *Jour. Exp. Psych.* 23: 201-205.

Our present hypothesis is that certain subjective factors previously postulated, for example tendency to change responses, and the tendency to avoid a symmetrical pattern, operate differently under different instructions, and therefore will necessitate analyses of additional data to clarify the situations. It is hoped that data from other situations may be made available for these analyses. Otherwise, tests made up specifically for the purpose will have to be given to supply the needed data.

GOODFELLOW, L. D., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 178.

WOLFGANG KÖHLER, Swarthmore College

Grant No. 528 (1941), \$600. Experimental schemes to demonstrate and to clarify the nature of the Höffding function in animals.

Observations have been made by Dr. W. D. Neff and myself concerning so-called field action in memory and in perception. Recognition, recall, and conditioned responses presuppose that between a new process and the traces of previous similar events, a specific functional connection tends to be established.<sup>1</sup> For historical reasons it is suggested that this selective action of similarity be called the "Höffding function." The necessity of assuming such a function in human recall has been demonstrated by experiments in which the new process and traces of corresponding previous events had different locations. Such experiments are made possible by the fact that human subjects can fixate a given point. In analogous experimentation with animals this condition cannot be fulfilled. But the operation of the Höffding function can also be demonstrated in a situation in which either one or the other of two different stimuli appears in a given location and the animal learns to react to the stimuli with two different responses. In our experiments two cats learned to approach and to open a box right before them when an area above the box appeared in one particular brightness nuance, but to turn sideways into an alley whenever in the same area a certain other brightness was given. In both cases the choice was made from about the same position.

<sup>1</sup> A clear distinction should be made between the part which similarity plays in recall and the influence which it has on association. (Cf. W. Köhler. On the nature of associations. Proc. Amer. Philos. Soc., 1941, 84: 489-502.)

Therefore, although fixation was uncontrolled, statistically speaking, both stimuli were projected upon the same parts of the retinae in the course of many trials. Thus, the identification of one or the other stimulus was not possible on the basis of differences as to neural locus. If such identification was nevertheless demonstrated, it could be mediated only by a selective action of similarity between the present stimulus and corresponding traces. For one of the cats, White was coordinated with direct approach, Black with turning into the side alley; the other cat learned the opposite coordination of stimuli and responses. It was found that under these circumstances discrimination learning is extremely difficult. On the other hand, such learning proved to be possible if certain helps were given in the beginning of the training.

The objection might be raised that different brightness processes which cover the same area in a macroscopic sense need not have entirely identical locations in an histological sense. When stimulated by intense light, a given area contains a number of active neurones which remain inactive when the same area is less strongly stimulated. Therefore identification of bright and dark stimuli on an anatomical basis does not seem to be strictly excluded in these experiments. But this criticism can be answered by experiments in which "brightness constancy" is demonstrated in the cat. In crucial constancy experiments the cats actually responded to an area as the white one even though a shadow made stimulation in this area weaker than it was in the black area under intense illumination. It follows that in the cat the number of active neurones is not an essential factor in the identification of particular brightnesses.

From a more general point of view, the operation of the Höfding function does not appear restricted to specific interaction between present processes and corresponding traces of previous events. The unifying effect of specific similarities is just as conspicuous in perception as it is in recognition and recall. In the visual field of man, for instance, similarity is known to have a strong influence upon the spontaneous grouping of discrete stimuli. But in the present situation of psychology many refuse to take the observations of human subjects at their face value. At any rate, the Höfding function in perception would appear to be a much more substantial factor if it could be clearly demonstrated in ani-

mals. Encouraged by Krechevsky's experiments,<sup>1</sup> which demonstrated in rats grouping on the basis of proximity, we proceeded in the following manner. In a simple discrimination apparatus, two doors of square shape and equal size were covered with a paper of medium gray. On this ground a pattern of equidistant dots appeared. One half of the dots were white, the other half black. On one door white and black dots alternated in the horizontal direction, on the other door in the vertical dimension. In human vision this distribution of dots is immediately organized under the influence of specific likeness. The former pattern appears as a number of vertical rows, the latter as horizontal rows. Three cats learned without great difficulty to discriminate between these patterns. When learning was completed, they were tested in crucial trials in which each dot pattern was replaced by a single and continuous, white or black, stripe on the gray ground. With three animals these tests have been completed. The results show clearly that after training with the dot patterns horizontality or verticality has a positive valence in accordance with the dot patterns as seen by human observers. Although further tests are desirable, we feel justified in saying that similarity has the same organizing function in the visual field of cats as it has in human vision.

Our investigation will be continued.

LIVINGSTON WELCH, Institute for Research in Child Psychology,  
Hunter College

Grant No. 490 (1940), \$500. Influence of levels of abstractness on reasoning ability. (In collaboration with Dr. Louis Long of the same Institute.)

This study investigated the influence of the levels of abstractness of stimuli upon the discovery and generalization of the relationships existing between such stimuli. The reasoning process involved was inductive and the experimental technique was based upon Mill's Joint Method of Agreement and Difference. Forty children, ranging in age from 8 to 11 years, served as subjects. The task confronting the child was the isolation of the stimulus

<sup>1</sup> Krechevsky, I., 1938. A study on the perception of linear *gestalten* in the rat. *Jour. Genet. Psychol.* 52: 241-246.

—, 1938. An experimental investigation of the principle of proximity in the visual perception of the rat. *Jour. Exper. Psychol.* 22: 497-523.

which produced the given effect—the effect in this case being the presence of a lighted bulb at the end of a row of two blocks. The blocks used bore pictures of animals, foods, and vehicles.

In the first test the children were given an opportunity to discover the principle by themselves, but if they were unsuccessful, standardized hints were introduced. In this situation the causal factor was indicated by the presence of the same picture in the two rows with lights and by the absence of this picture in the row which had no light. In the second test the subjects were required to perceive that the two rows with lighted bulbs always contained two different species of the same class (for example, a camel and a lion). To arrive at a correct solution the children had necessarily to group the blocks into classes corresponding to the first hierarchy concepts. A third test involved the second hierarchy level and necessitated the use of second hierarchy concepts. Two members of each of the three second hierarchy concepts (animals, foods, and vehicles) were selected so that each sub-division of the second hierarchy was represented. The two species of any second hierarchy group were in different rows. A correct solution was contingent upon the realization that in each of the two rows with lights there was a picture of one member of the same second hierarchy.

It was found that as the level of abstractness was increased the ability of the child to generalize a known principle decreased. The results indicate that those children who discovered the principle by themselves were more efficient in applying it to abstract situations than were the children who needed hints. On the other hand, a number of children who were unable to discover the principle by themselves were nevertheless able to apply it to abstract situations; and the fact that a child could discover the principle carried with it no assurance that he could utilize it in the more abstract contexts.

An analysis of the verbal comments and explanations of the subjects indicated a close relationship between actual performance and the ability to verbalize the principle employed in the test situations. The completeness of the explanations was found to decrease as the abstractness of the tests increased. Partial explanations were given more frequently, and the number of irrelevant features mentioned increased as the situations became more abstract. General causes of failure on the reasoning problems were classified into two groups: (a) the focusing of attention on unimportant aspects of the test situation; and (b) the existence of cross classifications of the first

hierarchy concepts: e.g., putting the fruits with the animals—"because animals eat fruit"—instead of grouping the fruits and the vegetables together.

(The above project deals with one of several phases of inductive reasoning studied by the authors.)

WELCH, LIVINGSTON, 1942 (with LONG, LOUIS). Influence of Levels of Abstractness on Reasoning Ability. *Jour. Psych.* 13: 41-59.

## PHYSIOLOGY AND PATHOLOGY

RICHARD C. DE BODO, New York University College of Medicine

Grants No. 360 (1939), \$850, and No. 478 (1940), \$750. Studies on the relationship of the pituitary gland and hypothalamus to carbohydrate and water metabolism.

1. In collaboration with Dr. J. E. Sweet it has been shown that morphine exerts an antidiuretic action which was demonstrated in the following way:

When normal dogs in water equilibrium are given water by stomach tube they excrete it practically quantitatively within three hours. However, when morphine is given subcutaneously 35-40 minutes after the administration of water (allowing time for the absorption of the water from the stomach before the vomiting due to morphine occurs) the dogs excrete only a small fraction of the administered water. The same results were obtained when the water was administered intravenously following the subcutaneous injection of morphine.

As regards the mechanism of the antidiuretic action of morphine it was demonstrated that the neurohypophysis is essential to it. In animals in which the entire neurohypophysis has been destroyed (resulting in permanent diabetes insipidus), morphine does not exert any antidiuretic action whatever.

In collaboration with H. I. Bloch these studies were extended to other narcotics, namely sodium phenobarbital, sodium amytal, nembutal, chloralalose, chloral hydrate, and avertin. Of these phenobarbital was the only one that had an antidiuretic action in every animal studied. This action was like that of morphine in its constancy but was of lesser degree. Sodium amytal and nembutal also produced an antidiuretic action which however was not as constant as that of morphine or phenobarbital. Avertin had a marked anti-

diuretic action; chloralosane had no such action; and chloral hydrate had an antidiuretic action in many cases, but not in all.

In an effort to discover the mechanism of their antidiuretic action, the effect of these narcotics was studied in dogs in which the entire neurohypophysis had been destroyed (diabetes insipidus dogs). It was found that in these animals phenobarbital, amytal, and nembutal had absolutely no effect on water diuresis. Therefore it appears that the neurohypophysis is essential to the antidiuretic action of these narcotics as it is to that of morphine.

2. In collaboration with Dr. J. E. Sweet and H. I. Bloch it was established that hypophysectomized animals while sensitive to insulin are resistant to the hyperglycemic effects of adrenaline. The intravenous infusion of an amount of adrenaline which produces marked hyperglycemia in normal dogs has only a very slight and transient effect in the hypophysectomized in spite of the presence of large amounts of liver glycogen.

Further, in collaboration with H. I. Bloch it was found that there is a close parallelism between the insulin sensitivity and the resistance to the hyperglycemic action of adrenaline in partially and completely hypophysectomized animals. Insulin, 0.025 U/kilo injected intravenously, produces hypoglycemic shock in completely hypophysectomized dogs, but only a slight or negligible drop in blood sugar in normals. Adrenaline, 0.0035 mgm/kilo/min infused intravenously for five minutes, produces marked hyperglycemia in normal dogs, but only a slight and transient effect in hypophysectomized dogs. Partially hypophysectomized dogs are more sensitive to insulin and more resistant to adrenaline than normals, but less so than completely hypophysectomized dogs.

Despite this close parallelism we have found that the adrenaline resistance cannot be the cause of the insulin sensitivity because adrenal-inactivated (right adrenal removed, left denervated and demedullated) and cortine-treated-adrenalectomized dogs, although showing somewhat greater response to insulin than normals, are by no means as sensitive to it as hypophysectomized dogs.

Both insulin sensitivity and adrenaline resistance are dependent upon a common cause: impaired mobilization of liver glycogen. Factors normally effective in mobilizing liver glycogen are apparently ineffective in the absence of the anterior pituitary.



- 1940 (with SWEET, J. E.). The Antidiuretic Action of Morphine in Diabetes Insipidus. *Jour. Pharmacol. & Exper. Therap.* 69: 276.
- 1941 (with BLOCH, H. I.). The Effect of Narcotics on Diuresis. *Jour. Pharmacol. & Exper. Therap.* 72: 4.
- 1941 (with SWEET, J. E., and BLOCH, H. I.). The Rôle of the Anterior Pituitary in Adrenaline Hyperglycemia and Liver Glycogenolysis. *Amer. Jour. Physiol.* 133: 218.
- 1941 (with BLOCH, H. I.). Impaired Mobilization of Liver Glycogen in the Absence of the Anterior Pituitary as a Cause of Insulin Sensitivity. *Amer. Jour. Physiol.* 133: 217.

JOSEPH S. BUTTS, Oregon State College

Grant No. 445 (1940), \$300. Amino acid metabolism in relation to conversion to carbohydrates.

In investigating the fate of various amino acids in relation to transformation to carbohydrate or carbohydrate precursors, two criteria were used. First, deposition of liver glycogen following the feeding of the amino acid was taken as evidence that the amino acid is the precursor of the formed glycogen. Secondly the capacity of an amino acid to cause a decrease in an acetoneuria developed by feeding either sodium butyrate (which is referred to as an exogenous ketonuria) or allowing the animals to partake of a high fat, low protein diet for eight days before feeding the amino acid (called the endogenous type of ketonuria) was interpreted as further evidence of sugar formation.

In collaboration with Russell O. Sinnhuber and Max S. Dunn, convincing evidence was obtained which indicated that l(—)-tyrosine can be converted to sugar. After feeding this amino acid to rats, both criteria, namely the formation of liver glycogen and a decrease in an exogenous ketonuria, were fulfilled.

A second phase of this work was concerned with the metabolism of dl-valine, an essential amino acid, and dl-isovaline, a non-naturally occurring amino acid. After feeding these two compounds to rats, small but definite liver glycogen formation was found when dl-valine was employed. None was found when dl-isovaline was fed. As in the case of l(—)-tyrosine, dl-valine caused a decrease in the exogenous ketonuria; dl-isovaline was not included in this part of the work.

Again with Russell O. Sinnhuber, the rôle of two of the hexone bases was studied. l(+)-Arginine was shown to give rise to a

small amount of liver glycogen, as well as decrease an exogenously developed ketonuria. dl-Lysine failed to give any results under these same experimental conditions and must be considered as a compound not involved in carbohydrate or acetone body formation, a view supported by work lately published from other laboratories.

The rôle of l(—)-histidine in relation to carbohydrate metabolism has also been studied. This investigation has been partially supported by the American Philosophical Society. It was being done in association with LeMar F. Remmert. The results indicated that this basic amino acid was also converted to carbohydrate. This conversion does not occur until twelve to sixteen hours after feeding the amino acid. Such a delayed response might indicate a preliminary transformation to some other intermediate before the conversion to carbohydrate. Further support of the hypothesis of transformation to sugar was furnished by studying the effect of feeding the amino acid to animals in which a ketosis of the endogenous type was evoked. A definite decrease in the acetonuria was the result when small doses were employed. When the dose was increased the amino acid proved to be extremely toxic, causing a marked hematuria in a large percentage of the animals. It is of interest to note that little effect on the acetonuria was noted during the first twenty-four hours of the experiment. This observation supports the hypothesis of the delay in sugar formation as shown in the experiments on liver glycogen. During the next forty-eight hours the ketonuria was very materially lowered.

BUTTS, JOSEPH S., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 136.

— 1941 (with SINNHUBER, R. O., and DUNN, M. S.). Effect of l(—)-Tyrosine on Liver Glycogen in the Normal Rat. Proc. Soc. Exper. Biol. & Med. 46: 671-673.

— 1941 (with SINNHUBER, R. O.). Studies in Amino Acid Metabolism. VI. The Metabolism of dl-Valine and dl-Isovaline in the Normal Rat. Jour. Biol. Chem. 139: 963-969.

— 1941 (with SINNHUBER, R. O.). Studies in Amino Acid Metabolism. VII. The Metabolism of l(+)-Arginine and dl-Lysine in the Normal Rat. Jour. Biol. Chem. 140: 597-601.

— 1941 (with REMMERT, L. F.). Studies in Amino Acid Metabolism. VIII. The Metabolism of l(—)-Histidine in the Normal Rat. (Submitted for publication in Jour. Biol. Chem.)

ROBERT GAUNT, New York University

Grant No. 454 (1940), \$400. Studies on steroid hormones: I. in lactation; II. in water metabolism; III. metabolism of desoxycorticosterone.

I. It has been previously demonstrated that the lactation failure which follows adrenalectomy in the rat can be prevented by adrenal cortical extracts, but only if relatively large doses are given. To elucidate further the function of the adrenal in lactation a study was made of the lactation-supporting effects of various purified or crystalline adrenal fractions. The following results were obtained:

Desoxycorticosterone in various doses failed to support lactation despite the maintenance of excellent health in adrenalectomized mothers (12 of 13 litters died), and may have further inhibited it.

The amorphous fraction of Kendall, given orally in doses approximating 0.5 cc. daily, had slight if any beneficial effect. Similar amounts of whole extract, which was of equal potency in maintaining the adrenalectomized dog, supported a normal lactation.

Compound E (17-hydroxy-11-dehydrocorticosterone) or Compound A (dehydrocorticosterone), given orally or parenterally in doses approximating 0.5 mg. daily, was beneficial and maintained a growth rate in suckling young which approached but did not reach normal (9 of 10 litters lived).

When Compound E was given orally in doses of 1 mg. per day a normal lactation ensued in 5 adrenalectomized mothers.

It was concluded that the adrenal secretions necessary for the maintenance of lactation probably belong to that group of substances containing an atom of oxygen at carbon atom 11.

II. It has been shown that adrenalectomized animals excrete excess forced doses of water slowly and are much more susceptible to water intoxication than are normal animals. A study was made of the comparative potency of various adrenal preparations in protecting adrenalectomized rats against excess water. The rate of excretion of the water (administered in standardized doses by stomach tube) and the occurrence of convulsions, prostration and death were the criteria observed. The following conclusions were drawn:

1. When compared to a whole extract of the adrenal cortex in sesame oil solution, desoxycorticosterone is relatively less effective in protection against excess water than in the maintenance of life and growth. Three mg. of desoxycorticosterone were needed for

full protection against the doses of water used, although lesser amounts were helpful.

2. Compound E (17-hydroxy-11-dehydrocorticosterone) was at least three times as efficient as desoxycorticosterone and gave full protection at a 1 mg. dose level.

3. The amorphous fraction of Kendall was only weakly effective in preventing water intoxication when compared with a whole extract of equal potency in maintaining the adrenalectomized dog.

4. All substances used were, however, beneficial if large enough doses were given; and it was concluded that by this test quantitative, but not qualitative, differences in the effects of various adrenal substances used can be demonstrated.

III. We confirmed the fact (Kiuzenga *et al.*; and others) that desoxycorticosterone acetate in oil (DCA), given in a single daily dose by gavage, is ineffective in maintaining life in young adrenalectomized rats in doses (0.5 mgm./day) about ten times greater than those needed subcutaneously. Such a wide discrepancy between oral and parenteral dosage does not exist for cortin and other crystalline cortical steroids. This suggested that DCA, like the chemically allied sex hormones, might be inactivated in the liver. This was tested by implanting pellets of DCA (mixed with cholesterol) in the spleens of young adrenalectomized rats—in which site gonad hormones are inactivated due to their immediate hepatic portal drainage. Controls received similar pellets in the kidney, subcutaneously and intraperitoneally. The pellets were of such size as barely to afford life maintenance in most but not all animals, so there was no excess of hormone involved. There was no significant difference in growth and survival between animals with pellets implanted in the spleen and their various controls. This indicates that the tissues of the liver and spleen do not inactivate DCA; and that, when given orally, it must be destroyed in the gut, since, according to Kiuzenga *et al.*, it is not detectable in the feces.

GAUNT, R., 1941. Inability of Desoxycorticosterone to Maintain Lactation. *Proc. Soc. Exp. Biol. and Med.* 47: 28.

—— 1941. Desoxycorticosterone and Lactation. *Proc. Amer. Physiol. Soc.*: 101.

—— 1941 (with EVERSOLE, W. J.). Desoxycorticosterone: A, Its Loss in the Digestive Tract, B, Effect on Water Intoxication. *Proc. Amer. Physiol. Soc.*: 83.

- 1941 (with KENDALL, E. C.). Adrenal Steroids in the Maintenance of Lactation. *Anat. Rec.* 81: (Suppl.) 99.
- 1942 (with EVERSOLE, W. J., and KENDALL, E. C.). The Effects of Adrenal Steroids in Water Intoxication. *Amer. Jour. Physiol.* 135: 378.

ARTHUR CHARLES GIESE, Stanford University

Grant No. 475 (1940), \$500. Effects of ultraviolet light on the respiration of microorganisms.

The endogenous respiration of the yeast *Saccharomyces cerevisiae* was found to be stimulated by ultraviolet radiations from a Sterilamp under one set of conditions, retarded under another. The rate of endogenous metabolism was increased several hundred per cent when yeast which had been washed free of nutrient was aerated for twelve hours before use so that the respiratory rate preceding irradiation was low. The acceleration in rate lasted for several hours after irradiation. It is tentatively concluded that the radiations release materials in the cell some of which may serve as nutrients, others may act as catalysts increasing the rate of consumption of the cell substance.

When yeast grown on a rich nutrient medium was merely washed free of nutrient but not aerated, the rate of endogenous respiration was high and was retarded by irradiation with dosages equal to those which stimulated in the experiments reported above. Also if cultures washed and aerated as in the first experiments were supplied with an excess of glucose, the rate of respiration declined after irradiation. The conclusion is drawn that the enzym systems are injured by irradiation and that when nutrients sufficient to saturate the enzymes are supplied, such injury shows up as a decrease in rate, for in excess of nutrient the rate of respiration is determined by the concentration of enzymes.

Experiments were also tried with the protozoan *Tetrahymena geleii*, the mycelium of the mold *Neurospora crassa*, the luminous bacterium, *Achromobacter Fischeri* and the sperm of the sea urchin, *Strongylocentrotus purpuratus*. Stimulation was obtained only in the case of *Achromobacter* under conditions similar to those for yeast. It is possible that in the other cases the right conditions were not supplied, although a variety of conditions were tried. Thus while the phenomenon of stimulation is not entirely limited to yeast it may not be general.

RUSSELL W. H. GILLESPIE, University of South Dakota

Grant No. 375 (1939), \$300. Bacterial oxidation-reduction studies: characteristic potentials of *Escherichia coli* and *Aerobacter aerogenes*.

Strains of bacteria tentatively identified as *E. coli* and *A. aerogenes* were subjected to oxidation-reduction potential studies. The strains were isolated from fecal specimens and water samples.

The apparatus and methods used in these studies were essentially the same as those described previously.<sup>1</sup> The potentials were determined by means of platinum and gold electrodes and a vacuum tube potentiometer circuit. A 3.5 N calomel half-cell was used as a reference electrode. The cultures were grown under strictly anaerobic conditions created by the continuous flow of purified nitrogen through carefully sealed electrode-culture vessels. Potential readings were made at intervals over the period of several days to a week, or more, required for the cultures to reach approximate stability.

The several strains of *E. coli* and *A. aerogenes* studied established relatively stable reduction potentials. The colon bacilli appear to be capable of creating reduced conditions of appreciably greater intensity than *A. aerogenes*.

The observed potentials (at hydrogen-ion concentrations near pH 7.0) are Eh — .23 to — .25 volt for *E. coli* and Eh — .19 to — .21 volt for *A. aerogenes*. Thus, it appears that well defined levels of reducing intensity characterize each of the relatively closely related species. The confirmation of these observations would establish a fifth instance of the differential value of O/R potentials.<sup>2</sup>

R. T. HILL, Indiana University School of Medicine

Grant No. 246 (1938), \$1,000. Studies on sex endocrines.

With the assistance of Martha T. Strong a series of studies was completed in which a comparison of synthetic androgens was made with naturally occurring ovarian androgens. We found that one androgen in particular (testosterone propionate), when injected simultaneously with an estrogen (Progynon-B) into castrated male

<sup>1</sup> Gillespie, R. W. H., and Rettger, L. F. 1938. Bacterial oxidation-reduction studies. I. Jour. Bact. 36: 605-620.

<sup>2</sup> Gillespie, R. W. H., and Porter, J. R. 1938. Bacterial oxidation-reduction studies. III. Jour. Bact. 36: 633-637.

mice, gave a growth response of the sex accessories very much like the growth curve obtained from ovarian androgens. Although a high physiological correlation was found, no presumption was made regarding the chemical identity of the ovarian male hormone.

A large number of ovaries (mice) were obtained which had been grafted in the ears of castrated male mice for long periods of time. These organs were studied in histologic preparations, keeping in mind the physiological activity of the gonads while existing as grafts. Evidence was found supporting earlier work in this series that the ovarian androgens are not dependent upon the existence of any special structure or group of structures within the organ. It is suggested that such male hormone function is a local metabolic chemism of the grafted gland.

A sex intergrade goat was presented to the laboratory, and it seemed of value to study in detail. Sterile abdominal testes were found, but no ovarian tissue. There was no detectable amount of female hormone activity in the organism, although androgenic function was noted. The uterus responded to female hormone injections. The genetics of the individual is discussed, and mention is made regarding the possible hormone requirements of cotyledons in the goat.

Assisted by W. W. Stalker a study has been made of estrogen effect on the blood sugars of hypophysectomized guinea pigs. Pituitary removal lowers blood sugars, but secondary stabilization usually follows, and at a normal level. Subsequent estrogen treatment further disturbs the blood sugar (lowering it), and is followed by survival in part of the animals with a lethal hypoglycemia in the remainder. The action of estrogens to produce this response is not fully understood, but it is supposed that the absence of the diabetogenic activity of the pituitary after its removal and a direct estrogen-pancreas relationship is probably involved.

HILL, R. T., 1940 (with STRONG, MARTHA T.). Ovaries Secrete Male Hormone. V. A Comparison of Some Synthetic Androgens with the Naturally Occurring Ovarian Androgen in Mice. *Endocrinology* 27: 79-82.

— 1941. Fate of Ovaries Which Have Been Grafted in the Ear for Long Periods of Time. *Endocrinology* 28: 426-430.

— 1941. The Abnormal Sex Anatomy of a Goat. *Endocrinology* 29: 1003-1007.

— (with STALKER, W. W.). Estrogens, Blood Sugars and Liver Glycogen in Normal and Hypophysectomized Guinea Pigs. (At present in manuscript.)

RUDOLF HÖBER, University of Pennsylvania Medical School

Grant No. 474 (1940), \$900. Studies concerning the influence of organic compounds upon the secretory activity of the kidney.

In previous studies (Report in the YEAR BOOK 1939, p. 239 to 241) it was shown that the selective secretory transfer of sulfonic acid dyestuffs by the isolated perfused frog kidney depends upon an appropriate molecular configuration, such as, for instance, that displayed by the azodyestuffs. The azo linkage connects the two halves of the molecule, each of which can be either polar or non-polar, depending on the radicals attached to the ring systems. The polar character is due chiefly to the presence of one or more sulfonate groups. Azodyestuffs having a distinct polar-nonpolar configuration are concentrated and transported by the kidney, whereas, in general, the polar-polar ones are not. This has been interpreted as being due to an orientation and attachment of the dyestuff molecules to the cell surface like in a Langmuir film, which has to precede further transport across the cells.

In order to approach somewhat more the normal transport action of the kidney, the studies have been extended to more simple organic substances than dyestuffs are. This has been achieved in the following manner. The kidneys were provided with one of the colorless molecular halves of the azodyestuffs and this half upon reappearing in the secretion was coupled in a diazo reaction to another half and determined colorimetrically. This procedure allowed us to study a great number of technical dyestuff intermediates. The following results were obtained: the monosulfonates of naphthylamine, naphthol and aminonaphthol, irrespective of the mutual location of the  $\text{NH}_2$  and  $\text{OH}$  and  $\text{HSO}_3$  groups, appear in the secretion at a higher concentration level than that in the perfusion fluid, whereas the disulfonates fail to become accumulated. It is suggestive to interpret these results in a way similar to that proposed with regard to the behavior of the azodyestuffs: affinities towards the cell surface are exhibited by the naphthalene ring system as well as by the  $\text{NH}_2$  and  $\text{OH}$  groups, affinities towards the aqueous surroundings by the strongly hydrophilic sulfonates. If two sulfonates are present, the polar affinities to the aqueous surroundings seem to be strengthened to such an extent that they prevent the attachment of the disulfonates to the cell surface, whereas in the monosulfonate molecules the opposing forces may balance



each other so that the molecular array in the interfacial boundary as the preliminary step in the active transfer can be formed.

Allowing such a tentative concept to act as a working hypothesis, it has been investigated whether the balance between the opposing intermolecular forces can be shifted in such a way that the secretory capacity of the kidney appears to be raised or to be diminished. As a matter of fact, substituting, for instance, in a naphthylamine sulfonate the naphthalene by a benzene, which has a smaller nonpolar affinity, disables the kidney to accumulate this compound, whereas by coupling two such aminobenzenesulfonates as in sulfanilylsulfanilate the nonpolar affinity is sufficiently strengthened so as to allow the attachment to the cell surface and the transfer. On the other hand, it also is possible to preclude the transfer by abolishing the polar-nonpolar structure, for instance, by replacing in sulfanilylsulfanilate the sulfonate group by the sulfonamide group, as in sulfanilylsulfanilamide. Correspondingly, sulfanilamide likewise fails to be concentrated by the frog kidney.

The same is true for several of the most well-known sulfanilamide derivatives, like sulfapyridine, sulfathiazol and others. However, in studying these compounds, another striking effect upon the kidney activity became obvious. The normally acid reaction of the secretion of the perfused kidney is turned to an alkaline reaction by those sulfonamides, which have an unsubstituted  $\text{SO}_2\text{NH}_2$  group, e.g., acetylsulfanilamide, whereas those with this group substituted, e.g. sulfaguanidine, do not. So far this behavior of the kidney is paralleled only by that of the enzyme carbonic anhydrase, the activity of which is stopped by the same group of sulfonamides, which stop the acid secretion. It is suggestive to interpret the pH shift observed as being due to the inhibition of the reabsorption of bicarbonate from the urine, which normally is catalyzed by carbonic anhydrase.

HÖBER, RUDOLF, 1940 (with BRISCOE, P.). Conditions Determining the Selective Secretion of Dyestuffs by the Isolated Frog Kidney. *Jour. Cell. & Compar. Physiol.* 15: 35-46.

— 1942 (with BRISCOE, P., WOOLLEY, P., GREEN, W., and ZIMMERMAN, M.). Further Studies on the Correlation between the Secretory Power of the Frog Kidney and the Molecular Configuration of Organic Compounds. *Jour. Cell. & Compar. Physiol.* 19.

— 1942. Effect of Some Sulfonamides on Renal Secretion. *Proc. Soc. Exp. Biol. & Med.* 49: 87-90.

FRANK H. JOHNSON, Princeton University

Grant No. 552 (1941), \$300. Investigation of the fundamental mechanism of sulfonamide action in the metabolism of luminous bacteria.

It has been shown that the luminescence of various unrelated species of bacteria, including both marine and fresh-water types, is sensitive to sulfanilamide. Luminescence either of well washed suspensions or of broth cultures is immediately reduced in intensity when sulfanilamide, sulfapyridine, sulfathiazol, sulfaguanidine, and other sulfa- derivatives of chemotherapeutic importance are added. Respiration is affected only at considerably higher concentrations. Growth of cultures, likewise, is retarded or prevented only by higher concentrations than those affecting luminescence. The cells of faintly luminous cultures developing in the presence of certain concentrations of sulfanilamide, luminesce brightly when they are centrifuged and resuspended in a drug-free medium. Completely dark cultures that develop in somewhat higher concentrations of sulfanilamide, do not recover their luminescence at once when washed free of the inhibitor, but they give rise to brightly luminous sub-cultures on normal media, showing that no permanent change in characteristics has taken place in the organisms.

The kinetics of the luminescent reaction *in vitro*, in the presence of various sulfonamide compounds and of ethyl carbamate (urethane) has been studied in collaboration with Dr. Chase. With highly purified substrate (luciferin), and partially purified enzyme (luciferase), the site of action was found to be the enzyme, not the substrate. Moderate inhibitions were completely reversible, simply by dilution. Thus, with the extracted luminescent oxidative system the effects of sulfonamide compounds and urethane were similar, and related to narcosis.

In a study of the effects of hydrostatic pressure on bacterial luminescence, carried out in collaboration with Dr. D. E. Brown and Dr. D. A. Marsland, it was found that sulfanilamide belongs to a category of narcotics which apparently combine with, or are adsorbed upon, the enzyme. Their inhibitions are not reversed by hydrostatic pressure, at the optimum luminescence temperature of the species. They can be reversed, however, either by removing the drug from the medium, or by raising the temperature above that of the optimum. In both cases a dissociation of the enzyme-

inhibitor complex may be the cause for reversal. Other examples of compounds in this group are chloral hydrate, barbital, and *p*-aminobenzoic acid. Another group of narcotics, including urethane, alcohol, ether, chloroform, and novocaine, cause inhibitions that are reversible by applying hydrostatic pressure, up to around 500 atmospheres. These compounds apparently cause a shift in equilibrium between the native, active enzyme, and a denatured, inactive product. This equilibrium is present at all temperatures, but proceeds to the right as the temperature is raised. It goes to the right also, without raising the temperature, when any of the latter group of narcotics is added. The reversible denaturation is accompanied by an increase in molecular volume of the protein enzyme. This swelling can be counteracted by applying pressure, and the narcosis thus abolished. Hydrostatic pressure in the study of narcotic action is used for the first time in this work.

In contrast to the widely prevalent notion that sulfonamide inhibitions result from a competition between the drug and *p*-aminobenzoic acid, the present study indicates that they result from a much less specific combination with enzymes. Some proteins, enzymes, or tissues in general are genetically more susceptible than others. Hence, certain bacterial species, and likewise tissues of higher organisms, are more readily affected than others. Likewise, within one species of bacteria, two different enzymes may show a difference in sensitivity to the narcotic. This is well illustrated by the different concentrations required to inhibit the light-emitting and the respiratory enzymes. The well-known anti-sulfanilamide effects of *p*-aminobenzoic acid could be paralleled by urethane in experiments with growing cultures. In either case, luminescence was stimulated and the inhibitory effects of sulfanilamide antagonized. Growth appeared to be influenced to a much less extent. The stimulatory effects appear to be fundamentally the same as those frequently encountered with narcotics and poisons of various sorts in low concentration.

In summary, the fundamental action of sulfanilamide is that of a reversible narcosis, to which certain bacterial enzymes are especially susceptible. The "anti-sulfanilamide" compounds, such as *p*-aminobenzoic acid, can be logically interpreted as antagonistic narcotics, whose stimulatory effects in low concentration will occur even in the presence of another narcotic, and thus counteract the effects of the latter. It appears less likely that anti-sulfanilamide

compounds, *p*-aminobenzoic acid in particular, simply supply a substance which is normally involved in metabolism, and which is interfered with by competitive action of the structurally related sulfonamide compounds. The effects of temperature and of hydrostatic pressure on the inhibition of luminescence by sulfanilamide and other compounds have been especially important in arriving at a more precise picture of the basic mechanism of inhibition. It is related to the general problem of the action of narcotics.

- JOHNSON, FRANK H., 1941 (with MOORE, K.). Sulfonamide Inhibition of Bacterial Luminescence. *Proc. Soc. Exp. Biol. Med.* 48: 323-325.
- 1941 (with BROWN, D. E., and MARSLAND, D. A.). The Mechanism of Temperature and Hydrostatic Pressure Reversal of Narcosis in Luminous Bacteria. (Abstract.) *Anat. Record* 81 (supplement): 33.
- 1942 (with BROWN, D. E., and MARSLAND, D. A.). A Basic Mechanism in the Biological Effects of Temperature, Pressure, and Narcotics. *Science* 95: 200-203.<sup>1</sup>
- 1942. Mechanism of *p*-aminobenzoic Acid Action, and the Parallel Effects of Ethyl Carbamate (Urethane). *Science* 95: 104-105.
- 1942 (with CHASE, AURIN M.). The Sulfonamide and Urethane Inhibition of Cypridina Luminescence *in vitro*. *Jour. Cell. Comp. Physiol.* (In press.)

ROBERT F. PITTS, New York University College of Medicine

Grant No. 501 (1941), \$670. Study of central neural control of respiration.

A study has been made of the activities of central respiratory mechanisms in terms of the behavior of respiratory motor neurones to electrical and chemical stimulation of medullary respiratory centers. Additional information has been provided by observations of the changes in behavior of these motor neurones on ablation of rostral levels of the brain and elimination of specific respiratory reflex afferents.

In these studies, action potentials of single phrenic neurones dissected from the phrenic nerves of the cat were amplified and recorded along with a record of inspiratory volume. Electrical stimuli were applied to the medullary respiratory centers through bipolar needle electrodes oriented in the Horsley-Clarke stereotaxic instrument. Chemical stimulation of respiration was effected by addition of carbon dioxide in small amounts to the inspired gas.

<sup>1</sup> [The Prize of \$1,000 was given by the Amer. Assn. Adv. Sci. for this paper. Ed.]

Carbon dioxide produces its well known stimulation of respiration in three ways: by increasing the frequency of discharge of individual respiratory motor neurones, by increasing the numbers of these motor neurones that are active and by increasing the period of activity of the less excitable of these neurones. Electrical stimulation of the medullary inspiratory center with weak repetitive stimuli duplicates these results exactly. Stronger stimuli, however, produce a maintained rapid discharge of impulses in many phrenic neurones and in consequence deep inspiration maintained for the duration of stimulation. The frequency of impulse discharge, the number of active neurones and the depth of inspiration all are a function of the frequency and intensity of medullary inspiratory center stimulation.

Expiratory center stimulation produces exactly the opposite effects on discharge of phrenic motor neurones. Weak repetitive stimuli bring about a decrease in frequency of discharge of the individual neurones, a decrease in the number of neurones active and a decrease in the period of activity of these neurones. More intense stimuli bring about a cessation of activity of all inspiratory motor neurones and consequent expiration maintained for the duration of stimulation. Again these effects are a function of the frequency and intensity of stimulation.

These results necessitate knowledge of the exact limits of physical spread of stimulating current. This information has been provided by stimulating the medulla with electrodes placed at various distances from the descending root of the trigeminal nerve, recording the action potential conducted antidromically over the ophthalmic division of the fifth nerve. Physical spread of stimulating current is relatively slight. An intensity of eight volts at electrode tips diminishes to a threshold intensity of about one volt at a distance of less than one-half millimeter. Hence, a stimulus of such an intensity excites less than a cubic millimeter of brain tissue. Since each center (expiratory or inspiratory) is represented by some thirty cubic millimeters of the reticular formation, the extensive bilateral respiratory responses obtained on stimulation of less than one cubic millimeter indicate extensive excitatory synaptic connections within a given center and equally extensive inhibitory ones between centers.

Work in progress is directed toward an analysis of reflex mechanisms responsible for rhythmicity of respiration.

PITTS, ROBERT F., 1941. Differentiation of Respiratory Centers. *Amer. Jour. Physiol.* 134: 192-201.

— 1942. Excitation and Inhibition of Phrenic Motor Neurons. *Jour. Neurophysiol.* 5: 75-88.

#### RESEARCH COUNCIL ON PROBLEMS OF ALCOHOL

HARRY H. MOORE, *Director*

Grant No. 300 (1939), \$1,500. Toxic factors in alcoholism. (This investigation was carried out by Dr. George A. Jervis of the New York State Psychiatric Institute.)

A. Pathologic studies of the central nervous system were carried on in series of rats which had been: (a) intoxicated with alcohol; (b) kept on diets deficient of various vitamins; (c) intoxicated with alcohol and kept on deficient diets. The results were as follows: Rats under (a) showed no pathologic changes; rats on vitamin B deficient diets showed hemorrhagic lesions of the midbrain and polyneuritis; when alcohol was added no increase of pathology was noted; rats on choline deficiency showed hemorrhagic-degenerative lesions of the cerebellum. These were not increased by the addition of alcohol.

B. Observations were made in monkeys intoxicated with alcohol and kept on nicotinic acid deficiency. Since tuberculosis invariably developed and complicated the pathologic findings, similar experiments are now in progress using swine as experimental animals.

C. Pathologic studies of the central nervous system were carried on in series of guinea pigs which were treated with alcohol and kept on Vitamin C deficiency. The results were negative, no significant pathologic changes having been observed in either group.

D. Observations were made of the toxic effect upon the central nervous system of substances which are known to be present in abnormal amounts in avitaminosis and alcoholism. Pyruvic acid, pyruvic aldehyde (methylglyoxal), lactic acid were found to produce no changes of the nervous system. Porphyrins were found toxic and their action is at present investigated.

CHARLES S. SHOUP, Vanderbilt University

Grant No. 502 (1941), \$100. Luminescence and oxygen consumption of *Photobacterium fischeri* in oxygen—carbon monoxide mixtures; determination of nutritional requirements of *Allomyces* by measurement of oxygen consumption.

Previous attempts to study the action of CO on oxygen consumption of luminous bacteria (Shoup, 1933)<sup>1</sup> by the dimming-point method of Harvey, have been repeated with use of a photometer for estimation of luminous intensity and the Fenn differential volumeter for measurement of oxygen consumption.

In these experiments *Ph. fischeri* in 0.20 Mol. phosphate buffer at pH 7.3 show no diminution of luminous intensity at moderate to high (as much as 95 per cent CO) ratios of CO/O<sub>2</sub> as that reported by Van Schouwenburg and Van der Burg (1940)<sup>2</sup> for *Ph. phosphoreum*. Thus far in the course of this investigation no evidence is at hand of stimulation of luminescence by CO in any concentration. Oxygen consumption by *Ph. fischeri* appears to be less sensitive to increasing CO/O<sub>2</sub> ratios than *Ph. phosphoreum*, and possibly more sensitive than *Micrococcus cyanophos* examined by Claren (1938).<sup>3</sup> A series of 18 experiments shows a concentration of 40 per cent CO—60 per cent oxygen just diminishes oxygen consumption by *Ph. fischeri* in the dark or in moderate illumination to not more than 5 per cent below the normal control level for any bacterial suspension studied. Any effect of illumination appears to be slight, and only attained with intense light. Reduction of oxygen consumption to one-half (50 per cent) of the normal rate is only reached at 90 per cent CO—10 per cent oxygen, with reduction to 20 per cent of the normal rate at 95 per cent CO—5 per cent oxygen in the gas mixture. A reduction of oxygen concentration with accompanying increased CO partial pressure where oxygen concentration is less than 3 per cent will cause an additional diminished oxygen consumption due to oxygen lack.

The determination of nutritional requirements of *Allomyces* by measurement of oxygen consumption was carried out with the cooperation of Fred T. Wolf.

<sup>1</sup> Shoup, C. S., 1933. *Biological Bull.* 65 (2): 370.

<sup>2</sup> Van Schouwenburg, K. L., and Van der Burg, A., 1940. *Enzymologia* 9: 34-42.

<sup>3</sup> Claren, O. B., 1938. *Ann. d. Chem. (Liebig)* 535: 122.

Although the aquatic Phycomycete, *Allomyces*, is easily cultivated upon a variety of media, it has never been grown nor studied in a wholly synthetic medium of known composition, and no precise knowledge of metabolism or nutritional requirements within this genus is available.

In these investigations four species (*A. arbuscula*, *A. javanicus*, *A. moniliformis*, and *A. cystogenus*) have been studied to determine the extent of utilization of various pure substances as shown by increase of metabolism over the basal or endogenous level of washed and starved mycelia. The method involved measurement of the oxygen consumption of the mycelia, using the Fenn differential volumeter. The rate of oxygen consumption of a starved mass of organisms maintained without oxidizable substrate was obtained in phosphate buffer at pH 7.3. Following addition of substrate, a second determination of oxygen consumption was made for extent of utilization of the added substance. Substrates employed include carbohydrates and amino-acids of physiological importance; mannitol, d-arabinose, l-arabinose, glucose, levulose, galactose, cellobiose, maltose, lactose, sucrose, dextrin, soluble starch, peptone, glycine, alanine, leucine, tyrosine, aspartic acid, asparagin, glutamic acid, cystine, and arginine.

It would appear from comparative measurements on the four species that mannitol, d-arabinose, l-arabinose, levulose, galactose, cellobiose, lactose, soluble starch, glycine, and tyrosine are not utilized by these members of the genus *Allomyces*. Peptone, dextrin, aspartic acid, and glutamic acid are assimilated by all four species. The remaining substrates are utilized by one or more of the species of *Allomyces*, but not by all. We believe that the four species of aquatic fungi under consideration differ physiologically as well as morphologically.

WILLIAM F. WINDLE and HOWARD L. ALT, Northwestern  
University Medical School

Grant No. 494 (1940), \$800. The normal blood picture in early infancy and some possible factors concerned in producing anemia during the first year of life.

We have completed one part of our investigation and have assembled data on other aspects of the general problem, but studies on the infants at the 9 to 10 month period are still in progress. The completed part of our work concerns blood volume at birth.



One or two blood volume estimations were made on 35 infants by the Evan's blue method and the Evelyn photoelectric colorimeter. The cord was clamped immediately after birth in 17; clamping was delayed until the placenta had separated in 18. All deliveries were without narcosis. Ninety cubic centimeters or more of blood (averaging 107 cc.) were collected from the severed placental end of the cord in the former; none was obtainable from the latter because uterine contractions had transfused the placental blood into the newborn. Blood volume estimations were made 15 minutes to 3 hours after birth and/or on the third day.

There were no significant differences between day of birth and third day values. The average total volume in all those retrieving placental blood at birth (24 experiments) was 361 cc. or 11.8 per cent body weight. The hematocrit was 60 per cent, and the plasma volume was 138 cc., or 4.5 per cent of body weight. After depriving the newborn of 107 cc. of placental blood the average total volume was 301 cc., or 9.6 per cent body weight. The hematocrit was 51 per cent and was equal to the hematocrit of the umbilical cord blood. The plasma volume, 140 cc. or 4.5 per cent of body weight, was not altered. Differences were statistically significant.

It was estimated that more than 26 per cent, but less than 34 per cent, of the average total fetal blood is in the placental circulation at the end of prenatal life. Under normal birth conditions most of this blood passes to the newborn as the uterus contracts upon the placenta during the third stage of labor.

A rapid adjustment of the plasma volume accompanied by concentration of the formed elements of the blood takes place after birth when blood from the placental circulation is transfused to the newborn. By means of this mechanism the infant's tissue fluids are increased, and there is a rapid elevation of the red corpuscle count and hemoglobin value of the infant's blood.

WINDLE, W. F., 1941 (with WILSON, E. E., and ALT, H. L.) Deprivation of Placental Blood as a Cause of Iron Deficiency in Infants. *Amer. Jour. Dis. Child.* 62: 320-327.

— 1942 (with DEMARSH, Q. B., and ALT, H. L.). Blood Volume of the Newborn in Relation to Early and Late Clamping of the Umbilical Cord. Abstract to appear in *Proc. Amer. Physiol. Soc.*

## MEDICINE

HARRISON FITZGERALD FLIPPIN, Philadelphia General Hospital

Grants No. 431 (1940), \$500, and No. 540 (1941), \$500. Studies on the pharmacology, toxicology, and therapeutic effectiveness of the sulfonamides in pneumonia.

In collaboration with Dr. John G. Reinhold and Dr. Leon Schwartz, it has been demonstrated that sulfathiazole is rapidly absorbed from the gastro-intestinal tract of man and is rapidly excreted in the urine. Following the intravenous administration of sulfathiazole sodium, recovery of the drug in urine is practically quantitative. For most individuals the proportion of drug conjugated by the liver is low.

With Dr. Schwartz and Dr. S. Brandt Rose, it has been shown that in the treatment of pneumococcic pneumonia, sulfathiazole is equally effective as is sulfapyridine, and, at the same time, is less toxic.

Observations on the permeability of red blood cells to sulfathiazole made with Dr. Reinhold, Dr. Schwartz, and Miss Shlomith Bethlahmy showed that sulfathiazole is present in human red blood cells in lower concentrations than is sulfapyridine employed under identical conditions. This finding is perhaps of clinical importance as far as the development of hemolytic anemia is concerned.

With Dr. John S. Lockwood it was pointed out that maximum therapeutic effectiveness with the sulfonamides is obtained when the drugs are employed early in the infection process before tissue necrosis or pus formation takes place. In the treatment of pneumococcic meningitis, the importance of eradicating all possible foci of infection was stressed.

In collaboration with Dr. Schwartz, the importance of an early diagnosis and the prompt institution of specific therapy in all cases of pneumococcic pneumonia has been discussed. Also, the importance of an adequate fluid and salt balance was emphasized.

Observations made with Dr. Reinhold, Dr. Schwartz, and Dr. Albert H. Domm on the behavior of sulfadiazine in man has shown that sulfadiazine is readily absorbed from the gastro-intestinal tract, but is excreted somewhat slower in the urine than is sulfathiazole. Sulfadiazine is present in peritoneal and pleural fluids in concentrations approximating those in blood. In cerebrospinal fluid, con-

centrations averaging over 50 per cent of the blood concentration of the drug were found.

In association with Dr. Reinhold and Dr. Schwartz, data have been presented which show that there is no correlation between the therapeutic effectiveness and the concentration of sulfapyridine or sulfathiazole in the blood. However, there does exist a relationship between the development of hematuria and the amount of acetyl-sulfapyridine or acetylsulfathiazole in the blood.

With Dr. Rose, Dr. Schwartz, and Dr. Domm, data pertaining to the treatment of pneumococcic pneumonia with sulfathiazole and sulfadiazine have demonstrated that the two drugs are equally effective but sulfadiazine is the less toxic. This difference in toxicity is particularly apparent as to the incidence and severity of vomiting and of renal damage.

In a discussion on the modern treatment of pneumonia, the importance of watching for possible toxic reactions from the sulfonamide drugs has been stressed. Also, the advisability of combining specific sera with chemotherapy in certain instances was evaluated.

In collaboration with Dr. Schwartz and Dr. Jefferson H. Clark, data have been presented concerning the influence of certain factors on the fatality rate of pneumococcic pneumonia treated with sulfonamides. From this study it becomes apparent that a further reduction in mortality depends largely on the early institution of specific therapy in all patients with pneumonia.

The effect of alkali on crystalluria from sulfathiazole and sulfadiazine has been demonstrated in a study with Dr. Schwartz, Dr. Reinhold, and Dr. Domm. In order to decrease the incidence and number of drug crystals in urine, it seems advisable to administer an alkali with sulfathiazole and possibly also with sulfadiazine.

A fatal case of acute exfoliative dermatitis due to sulfathiazole toxicity has been reported by Dr. Mary Weinstein and Dr. Domm. The potential dangers of sulfathiazole dermatitis have been discussed.

The cardinal principles of sulfonamide therapy have been presented in detail. Emphasis has been placed on the therapeutic limitations, pharmacology, toxicity and method of administration of these drugs.

A paper dealing with the chemotherapy of acute infections has demonstrated the type of lesions in which the sulfonamide drugs

exert their maximum therapeutic effectiveness as well as other important factors concerned with their rational use in clinical medicine.

The modern control of pneumonia has been discussed in a paper which emphasizes the importance of close cooperation between the various public health agencies and the practicing physician. Data are presented showing the advantages of chemotherapy in the medicinal control of pneumonia.

With Dr. Domm, Dr. Reinhold, and Dr. Schwartz it has been shown that because of the relatively slow excretion of sulfadiazine by the kidneys, the intravenous use of sodium sulfadiazine is a satisfactory method of treating patients in whom oral therapy is impossible or impractical.

- FLIPPIN, HARRISON F., 1940 (with REINHOLD, J. G., and SCHWARTZ, L.). Observations on the Pharmacology and Toxicology of Sulfathiazole in Man. *Amer. Jour. Med. Sci.* 199: 343-401.
- 1940 (with SCHWARTZ, L., and ROSE, S. B.). The Comparative Effectiveness and Toxicity of Sulfathiazole and Sulfapyridine in the Treatment of Pneumococcic Pneumonia. *Ann. Int. Med.* 13: 2038-2049.
- 1940 (with REINHOLD, J. G., SCHWARTZ, L., and BETHLAHMY, S.). Permeability of Red Blood Cells to Sulfathiazole. *Proc. Soc. Exper. Biol. & Med.* 45: 317-318.
- 1940 (with LOCKWOOD, J. S.). Sulfathiazole and Sulfapyridine in the Treatment of Pneumococcic Pneumonia and Meningitis. *Med. Clins. N. Amer.*: 1789-1800.
- 1941 (with SCHWARTZ, L.). Sulfathiazole in the Treatment of Pneumococcic Pneumonia. *Penna. Med. Jour.* 44: 446-451.
- 1941 (with REINHOLD, J. G., SCHWARTZ, L., and DOMM, A. H.). The Absorption, Distribution, and Excretion of 2-sulfanilamidopyrimidine (Sulfapyrimidine, Sulfadiazine) in Man. *Amer. Jour. Med. Sci.* 201: 106-115.
- 1941 (with REINHOLD, J. G., and SCHWARTZ, L.). Sulfapyridine and Sulfathiazole Therapy in Pneumococcic Pneumonia. *Jour. Amer. Med. Assoc.* 116: 683-689.
- 1941 (with ROSE, S. B., SCHWARTZ, L., and DOMM, A. H.). Sulfadiazine and Sulfathiazole in the Treatment of Pneumococcic Pneumonia. *Amer. Jour. Med. Sci.* 201: 585-592.
- 1941. Modern Treatment of Pneumonia. *N. Carolina Med. Jour.* 2: 223-228.
- 1941 (with SCHWARTZ, L., and CLARK, J. H.). Factors Influencing the Fatality Rate of Pneumonia Treated with Sulfonamide Compounds. *Ann. Int. Med.* 14: 1969-1974.

- 1941 (with SCHWARTZ, L., REINHOLD, J. G., and DOMM, A. H.). The Effect of Alkali on Crystalluria from Sulfathiazole and Sulfadiazine. *Jour. Amer. Med. Assoc.* 117: 514-515.
- 1941. Cardinal Principles of Sulfonamide Therapy. *Jour. Missouri State Med. Assoc.* 38: 344-348.
- 1941. Chemotherapy of Acute Infections. *Med. Clins. N. Amer.:* 1799-1812.
- 1941. Modern Control of Pneumonia. *Jour. Missouri State Med. Assoc.* 38: 398-401.
- 1942 (with DOMM, A. H., REINHOLD, J. G., and SCHWARTZ, L.). The Intravenous Use of Sodium Sulfadiazine in the Treatment of Pneumococic Pneumonia. *Arch. Int. Med.* 69: 51-57.
- WEINSTEIN, MARY, 1941 (with DOMM, A. H.). Development of Acute Exfoliative Dermatitis During Administration of Sulfathiazole. *Jour. Amer. Med. Assoc.* 117: 607-608.

ALBERT V. STOESSER, University of Minnesota Medical School

Grant No. 389 (1939), \$500. Studies concerning water and electrolyte metabolism in intractable asthma of children.

For several years observations have been made concerning the influence of various procedures which alter the water and the electrolyte exchanges on the course of intractable asthma in children. Repeated experiments have shown that the administration of the anti-diuretic principle of the posterior lobe of the pituitary gland, namely pitressin, is able to reduce or eliminate asthma in a child suffering with a chronic state of the disease. The pitressin is most effective if the patient is on a diet low in sodium chloride. The asthma can again be precipitated by returning sodium chloride in fairly large amounts to the diet.

In order to reveal the exact nature of the changes in the water and the electrolytes associated with the periods of observations, balance studies with careful laboratory analyses were made. They revealed that the pitressin is able to permit the excretion of sodium chloride to such an extent that it is estimated very little remains in the body. On the other hand, potassium chloride is retained. The addition of sodium chloride reverses the procedure in that much of the salt is retained and the remainder which is excreted takes with it some potassium chloride. Incidentally calcium is also lost from the body during the period of relatively high sodium chloride feeding.

The same result can be obtained in another way. If adrenal cortex hormone or extract, or the adrenal steroid named desoxy-

corticosterone, is administered to the asthmatic individual, the patient's symptoms are made worse. The balance studies show that there is a tendency for the retention of sodium chloride and an excretion of potassium chloride. Again there is a fairly high loss of calcium in the stool. Thus it appears that pitressin and desoxycorticosterone have opposite effects on the asthma of an intractable case.

### CLASS III. SOCIAL SCIENCES

#### SOCIOLOGY

HAROLD FISHER WILSON, State Teachers College, Glassboro, N. J. Grants No. 397 (1940), \$200, and No. 506 (1941), \$200. A study of the social history of southern New Jersey during the nineteenth century.

This grant was the second one given to this project. It made possible further search for data on conditions of life in South Jersey during the nineteenth century, a continuation of the work instituted by the investigator four years ago and modeled in its scope and approach to the writer's doctoral thesis at Harvard, *The Hill Country of Northern New England, 1790-1930*.<sup>1</sup>

As a result of the grant, material was collected during the spring and summer of 1941 at the following places:

(1) The Library of Congress yielded information on transportation and pertinent census data which could not be obtained elsewhere.

(2) The writer was privileged to have access to the private library of Cora June Sheppard, Shiloh, Cumberland County, N. J., where data on nineteenth century South Jersey were found in letters, scrapbooks, and photographs.

(3) At the Vineland Historical Society, Vineland, N. J., material was gleaned from the diary of Richard Wood of Millville, the scrapbooks of Frank Andrews, and from out-of-print pamphlets dealing with real estate schemes in various parts of the area. The writer is scheduled to give an address before the Vineland Society based on his findings there.

(4) At the University of Pennsylvania Library statistics were collected on agricultural production in the eight counties of southern New Jersey and also information on the changing composition of population in the area.

<sup>1</sup> Columbia Univ. Press, 1936.

(5) Source data was found at the Cape May County Historical Society, Cape May Courthouse, where the writer had access to the manuscript journal of Dr. Reuben Willetts, the manuscript account of an 1835 beach party by Dr. James F. Leaming, the letters of Emma B. Aldrich containing reminiscences of church life in the 1850's, and the two scrapbooks of Francis B. Lee, nineteenth century New Jersey historian.

(6) The writer went on a field trip in the Mullica River region and the Pine area with Mr. William Bozarth of Egg Harbor City, who was born and brought up in that section. Conversation with people who had worked in the charcoal industry proved especially illuminating. Trips were also made to the sites of several old iron furnaces, all of which helped to give the writer the "feel" of the region.

(7) Investigation at the Atlantic City Library yielded material from the Laura Williams Colwell manuscript on old Weymouth and from Watson's *Annals of Philadelphia*, and at the Atlantic County Library at Mays Landing, data were gathered from various out-of-print pamphlets.

(8) Considerable time was spent at the Gloucester County Historical Society Annex in the Courthouse at Woodbury, which contains the valuable files of the Woodbury "Constitution." The years 1860 to 1880 were covered and worthwhile material collected, especially on conditions in the glass works at that time. Next summer the writer hopes to be able to complete going through the files of the "Constitution" to 1900.

(9) The State Library at Trenton yielded pertinent material from the Reports of the State Board of Agriculture, the State Board of Health, and the State Board of Road Commissioners, while the Colporteur Records of the American Tract Society, published by the Historical Records Survey of New Jersey, gave usable data, particularly on conditions in the Pines.

(10) The summer's investigation was concluded with work at the Burlington County Historical Society, the Secretary of which gave the writer access to many of the papers read before Society meetings. These contained interesting bits on local history in that section during the period under study.

The notes already taken have been arranged into tentative chapter headings and some rough drafting has been done on the proposed book. The investigator plans to consider such topics as

population trends in South Jersey, the Jewish colonies in the area, the implications of the growth of Negro population, the impact of Italian immigration, the spread of Philadelphia into South Jersey (suburban movement), the development of the recreation industry on "the shore," the growth of transportation facilities, and highlights of life during the days of the glass and the bog iron ore industries.

Little has been published on these topics and no books have been written on South Jersey that approach the subject from the point of view of the social historian.

WILSON, HAROLD FISHER, 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 276-277.

### MODERN HISTORY

FRANCIS HARPER, The John Bartram Association, Philadelphia

Grants No. 291 (1939), \$500, and No. 495 (1940), \$500. The preparation for publication, with adequate annotations, of John Bartram's manuscript diary of his journey through the Carolinas, Georgia, and Florida in 1765-66; of William Bartram's manuscript report to Dr. John Fothergill on his travels in Georgia and Florida in 1773-74; and of a new edition of William Bartram's *Travels* (1791).

This report is supplementary to the last two annual reports of progress, as published in the YEAR BOOKS for 1939 and 1940.

The work of annotating and illustrating the two Bartram manuscripts has been completed, and the volumes have been submitted for publication. Chief attention during the present year has been devoted to a new edition of the *Travels*, which is designed particularly for the use of naturalists. Dr. John R. Swanton, of the Bureau of American Ethnology, has generously contributed some comments on the ethnological portions of the book, to be added to the comments that I have prepared on geographical, historical, and biological features. The first draft of an extensive annotated index has also been completed. The preparation of an introduction, illustrations, and a final draft of the index will bring the present undertaking to completion.

Much new information has been gleaned from various sources concerning William Bartram's routes, the location of Indian villages that he mentioned, and the identification of plants and animals that he described.



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- 1941. William Bartram's Status as a Naturalist (Abstract). Science 94: 552.
- Two More Available Plant Names of William Bartram. Bartonia. (In press.)
- The Name of the Warmouth. Copeia. (In press.)
- The Name of the Florida Wolf. Jour. Mammalogy. (In press.)
- John Bartram; Diary of a Journey Through the Carolinas, Georgia and Florida, 1765-66. (Accepted for publication by Amer. Philos. Soc.)
- William Bartram; Travels in Georgia and Florida, 1773-74. (Accepted for publication by Amer. Philos. Soc.)

ELSIE MURRAY, Tioga Point Museum, Athens, Pa.

Grant No. 470 (1940), \$800. Study on French refugees of 1793 on the Susquehanna.

"Azilum," the north Pennsylvania colony of refugees from the Terror, has long been recognized as a focal point in exile of French notables, many of them comrades-in-arms of American officers a few years earlier in our War of Independence. La Rochefoucauld-Liancourt, who visited Azilum in 1795, devoted twenty pages of his *Voyage dans les États-Unis d'Amérique, fait en 1795, 1796, et 1797* in 1799 to the new town, prophesying a prosperous future. In 1903 and 1917, a descendant of one of the exiles, L. W. Murray, published the story of the years 1793 to 1803, documented with manuscript material in Tioga Point Museum and elsewhere. During the past year research on the colony, and the land company launched in its behalf by Robert Morris, in newly discovered sources in New York, Philadelphia, Harrisburg and Washington libraries and archives, has turned up facts and dates, relative to the principal settlers and shareholders, needed to weave the narrative into a coherent whole.

Robert Morris, financier of the American Revolution, and organizer of the Asylum Land Company in 1794, when the European crisis forced General Louis de Noailles and Antoine Omer Talon, ex-governor of the Châtelet, to abandon earlier plans for the colony, has often been carelessly censured as a greedy and reckless land speculator. His letter-books in the manuscript division of the Congressional Library, however, show his aims to have been three-fold: the utilizing of the vacant lands of the United States to provide a refuge for distressed Europeans, the paying off of our war

debts by such sales, and incidentally, the retrieving of his own depleted fortune. Existence of a three-million-acre deed to Morris from the United States government, in payment of his services and loans during the Revolution, recorded on a parchment made of four deerskins, and now in possession of a descendant, an officer in the United States Army, has been reported to the writer by the Pennsylvania State Archivist, though examination has been deferred by recent military exigencies. Its existence, however, suggests the approach by which Morris became involved in land operations.

An agreement dated December 1792 between Robert Morris and John Nicholson, and John Mussor and Thomas Grant, has been discovered in the Lycoming County Courthouse, calling for the survey of 500,000 acres, in the New and Old Purchases. While this may relate to the Holland Land Company purchase, it suggests that plans for Azilum, in which Nicholson, Pennsylvania Comptroller-General, was associated with Morris, were laid before the arrival of refugees in 1793, perhaps with a view to assuring the hideout for constitutional monarchy, the tradition of which is preserved locally.

The survey may have been requisitioned, however, in the interest of another land deal of the period, negotiated abroad by Morris' son and Gouverneur Morris, our minister to France; i.e., the 80,000-acre sale of the north Pennsylvania border from the Susquehanna to the Delaware to Le Ray de Chaumont, French backer of Benjamin Franklin and John Paul Jones. Papers in the Tioga Point Museum relating to the management of this property reveal that Necker, ex-minister of finance to the French crown, and his daughter, Madame de Staël (at that time the centre of a coterie sympathetic with constitutional monarchy and the royal captives in the Temple, and contemplating emigration), were interested in this strip of country. On it about a century ago, one of the Fourier cooperative phalanxes, similar to Brook Farm, sprang up, with its own newspaper, for a brief period at Le Raysville.

The enthusiasm for the New World of the vicomte Louis Marie de Noailles, shown by letters in the hands of Robinson heirs to have suffered not at all from his picketing with this Quaker family in 1780-81 at Newport, found an outlet in the Azilum project, and in his eleven years' residence as land agent and broker in Philadelphia (1793-1803). In the *Liste Générale des Émigrés* of 1793 in the Johns Hopkins Library, a Noailles from Correze is set down

as emigrating June 21, 1792—the approximate date of the royalist purging of the northern army in which Louis Marie was serving. Letters from England in the Jackson and Robinson collections late in 1792 state his intention of leaving shortly for America, but whether his sailing was delayed till the end of Louis XVI's trial and death is uncertain. In his oath of allegiance to Pennsylvania, July 10, 1793, he is set down as of Santo Domingo, indicating he may have stopped at the Antilles in crossing<sup>1</sup>—just grazing the Cap François atrocities and the rise of Toussaint L'Ouverture, the Haiti liberator. On June 19 Genêt, hotheaded minister from the new French republic, reaching Philadelphia May 16, 1793, reported angrily back to France the reception of Noailles with letters from the "pretended Regent" by Washington. This sets the date of his arrival just prior to the new July flood of Santo Domingan refugees on our coast, and the collapse in Paris of the last plot to rescue the Royal Family from their Temple prison.

Numerous sources reveal Noailles' occupation with land colony schemes for the ten years ensuing. [Following the guillotining of his wife and parents in 1794, his three children were cared for by his sister in a safe retreat and never emigrated, unlike his young nephew, Lafayette's son, who was remanded to the care of his godfather, President Washington, in America.] In the back of Jay's account book in the United States National Archives, the vicomte's name appears among those applying for a passport to Santo Domingo in 1800, on the ground of possessing property there, though no clew as to his relationship to young Guy de Noailles, listed by Liancourt as of that island, has developed. Details of the death of General de Noailles early in 1804 following his removal from the list of émigrés and his attempted rescue of a number of French colonials from the Antilles, then under British attack, are given by his sister.<sup>2</sup>

It is evident that the lives and fortunes of a large number of Azilum colonists were closely linked with Santo Domingo and other of the West Indies—last of France's New World possessions; where hasty publicizing of the radical principles of the French Revolution gave rise to fierce conflicts between the African slaves who worked the sugar and coffee plantations, the mulatto land proprie-

<sup>1</sup> Pennsylvania Archives, Ser. II, 3: 64 f. (in 1890 ed.).

<sup>2</sup> Thus refuting Genêt's accusation that he was agent for the transfer of these treasured possessions to England.

tors, and the whites. In fact, the plight of refugees from successive insurrections in the Antilles—whose reverberation was to be long felt in our own South—was a potent incentive, alongside the royalist hopes above hinted, for setting the Azilum project in motion.

Additional data relate to St. Mémin's "Designs for a Proposed French Settlement on the Susquehanna," perhaps the maiden effort in engraving of this distinguished self-taught artist in exile; and to the revelation during trial under Napoleon in 1803 of Omer Talon, of a plan launched in 1792 by Danton for deportation of the captive Royal Family.<sup>1</sup>

Recently published letters of Captain du Petit-Thouars, hero of Aboukir, and advance sheets of the private Journal of the Duke de Liancourt, fill many old gaps in the record. A geographic survey of the town site and the outlying tracts of the Asylum Company discloses a region in the forested hills of northern Pennsylvania, undeveloped even today as a farm or industrial area, yet rich in coal and iron pockets, in trout streams and natural game preserves, scenic and recreational attractions, and lumber. A full narrative of the colony-history of book length is underway.

RODNEY H. TRUE,† University of Pennsylvania

(Work continued by EDWIN MORRIS BETTS, University of Virginia)

Grant No. 316 (1939), \$750. Editing Jefferson's *Garden Book*.

Dr. Rodney H. True, some months before his death, began the work of editing Jefferson's *Garden Book*. He wrote an introduction to the *Garden Book* and made a few written marginal notes relative to certain items in it. After Dr. True's death, the grant which he had held was turned over to me in order to continue and complete the work.

Jefferson made the first entry in his *Garden Book* on March 30, 1766, while still living at *Shadwell*. The last entry was made on September 15, 1824, at *Monticello*. In between these two dates were packed many interesting entries, not only on gardening but also on other varied subjects, which throw more light on this versatile man.

Jefferson's letters, memoranda, and account books, are widely scattered in libraries over the United States. In order to get a com-

<sup>1</sup> de Goutel, E. H. *Journal des Debats*, August 21, 1908.

† Deceased April 8, 1940.

prehensive view of Jefferson's interest in gardening and agriculture, and to cover all the entries in the *Garden Book*, these various manuscripts were examined. Jefferson Manuscripts have been read and studied at the Alderman Memorial Library, the University of Virginia; the Massachusetts Historical Society, Boston, Massachusetts, which Library owns the original *Garden Book*; the Pennsylvania Historical Society, Philadelphia; the American Antiquarian Society, Worcester, Massachusetts; the Harvard Library, Cambridge, Massachusetts; and the extensive collection in the Library of Congress, Washington, D. C. Interesting material has been secured, by correspondence, from the Jefferson Memorial, St. Louis, and the Huntington Library, San Marino, California. Other libraries have been consulted for possible material. In addition to the original manuscripts all of the published letters have been read. Nearly one hundred names of men and women are mentioned in the *Garden Book*. Short biographies are now being prepared of these men and women.

The preliminary work is almost completed. The actual editing work will begin early in 1942.

### GOVERNMENT

FRIEDRICH ENGEL-JANOSI, Johns Hopkins University

Grant No. 550 (1941), \$400. A struggle for Austria in Berlin and Frankfurt, 1849-1855. The beginnings of Bismarck's anti-Austrian feelings.

A survey is given on the political relations between Austria and Prussia in the period following the Congress of Vienna to 1849 when Prokesch was sent to Berlin as representative of a new and invigorated Austria, embodied in the government of Felix Schwarzenberg.

Prokesch's political and intellectual development is outlined, and his connections with Berlin, as well those prior to his arrival and those during his stay there, are described. He first attempted to make politics with Prussia, yet soon became the adversary of this state, in which he saw the champion of German national revolutionary trends; he undervalued the opposing conservative forces still at work under Frederic William IV. "The revolution will be victorious," he wrote, "it is Austria's fate to be again conquered, and Prussia's to conquer. But the esteem of those who think will be for ever with Austria;" and later: "the end of the Austrian way is

union, the end of the Prussian is separation." However he struggled for the Schwarzenberg plan of a Customs Union which should embrace the whole of the German Confederation and of the Hapsburg Monarchy and thus form a Central European Unity. After this plan had failed, the removal of Prokesch was asked by St. Petersburg as well as by Berlin. He was sent to the diet at Frankfort, where Bismarck already represented Prussia.

The social structure of Frankfort about 1850 is depicted according to the reports of the American consul there; then the views of Bismarck and Prokesch on the city, the diet and the representatives are contrasted, and the characterizations each one of the two diplomats gave of the other are paralleled.

Prokesch addressed the diet by surveying German history in a way in which influences of the Metternich-Gentz ideas may be found linked together with purely Romantic thoughts; he emphasized that Austria wanted a powerful German Confederation. A few days after this inaugural address the fight of Bismarck against Prokesch started and this struggle went on till Prokesch left the diet in 1855. The fight raged first on behalf of some minor questions which were brought to the diet; then the Oriental Problem arose and led to the Crimean War. The means which the Austrian and the Prussian diplomats used in this struggle are described.

When Prokesch in later years looked back on the period he had spent at the diet, he began with the statement that, when he left Frankfort, he felt that he had been freed from a crushing burden, "no longer forced to waste my life in the attempt to accomplish what was an impossible task." Yet in Frankfort in these years he had met Count Gobineau, then secretary at the French legation, to whom he wrote after an intercourse of a year: "I shall continue to live with you forever" and the correspondence between them did not come to an end until six weeks before Prokesch died in 1876.

WOLFGANG HALLGARTEN, University of California

Grant No. 433 (1940), \$1,000. Investigation of the changes in the ideological and socio-economic structure of imperialism, 1870-1940.

In the second part of the research period, which ended in the spring of 1941, the problem of ideological and sociological "re-feudalization" (cf. last report), its failure in the West and its success in Central Europe underwent further clarification.

(1) In Germany, the process of re-feudalization was facilitated by the peculiar historical structure of Germany's national ideals. German nationalism in the eighteenth century and in the first decades of the nineteenth was the ideology of a still undeveloped, pre-capitalistic middle class and of tiny principalities and princelets or counts, all opposed to the large territories which were either Lutheran or Catholic. The religious creed of many of those nationalist elements was the Pietist form of Protestantism (K. S. Pinson) which is closely related to English and American sectarianism yet which in Germany, after the more progressive period of the Herder, Fichte, and Schleiermacher—all of them Pietists and sympathizers with the French Revolution—developed into its opposite. The turn of the tide is marked by the appearance of Richard Wagner whose enormous importance as a political thinker and demagogue—analyzed by the reporter in *Zeitschrift für Freie Deutsche Forschung* (Paris, 1938)—was more recently discussed by T. A. Adorno and Peter Viereck (*Metapolitics*, 1941). Yet Viereck, in his otherwise brilliant study, failed to lay enough emphasis upon the social problem. It is true, Wagner was a typical representative of the German fight against Western civilization which, in Wagner's time, permeated Germany in the shape of industrialization and parliamentarization, giving the Pietist and Romantic forms of German nationalism little more than a breathing spell. Yet connected with this process was a social one. Wagner was the first in a long series of cultural and political thinkers derived from bourgeois ranks who became class renegades and who taught the middle class "aristocratic" ideals, an endeavor which, in the time of the Second Reich, with its flourishing economic life and its increasing business spirit was not yet fully understood. Political Wagnerism remained a sectarian creed until the German disaster in the last World War, the decline of the middle class and the increasing unemployment made the entire German people, both non-proletarian classes and workers, ripe for the gospel of new "feudalizers" from "below." Wagner's "Parsifal" is the ever-lasting symbol of the regeneration of a declining aristocratic world by an "unknown" hero from "below" who turns into a "savior," "Messiah," and purifier of the polluted "blood-community." Like Hitler, he erects a new "blood community" of his own. The wish to "punish" the aristocratic classes, a motif common to most previous dictators, is replaced, in the case of the Fascist leaders and thinkers and of their

forerunners, by the desire to "outdo" and "outbid" the aristocracy and to "aristocratize" entire populations.

(2) Different from Central Europe, the Western nations entered the period of Fascism without social protection against the "Bolshevist menace." Hence, their striking connivance towards their Fascist neighbors during the 1930's which contrasts so sharply with their attitude before 1914. While assisted in the beginning, by the traditional anti-militarism of the Leftists who, down to the moment of the War in Spain, lacked understanding of the changes in the world, pro-Fascist "appeasement" found its main apostles in the ranks of the political Rightists. It was especially strong in France whose monarchic, Catholic and aristocratic circles were still reminiscent of their sad experiences during the French Revolution while the English aristocracy, "commercialized" and faithful to the ideals of 1688, was the first in the ranks of the "appeasing" elements to turn against the Axis. Meanwhile, the development of "anti-colonization" (M. J. Bonn) and democratization in the Western empires, especially in the British Empire, which resulted from the mother countries' lack of manpower (France) and lack of military and bureaucratic tradition (England) had led to a growing de-centralization which, however, proved to be the opposite of disintegration, and which saved these empires in their struggle with the Axis.

(3) This entire evolution is reflected in the field of political theory by a destruction of the old theories of imperialism shaped before the last World War. The recent developments in the Western empires—the fight against aggression—have led to a sharp decrease in anti-imperialist Leftist publications. Anti-imperialist slogans of by-gone times are today mainly used by Axis super-imperialists, in order to conceal their own plans, and in accordance with their neo-feudal half-socialist attitude. Axis "anti-mammonism" continues the ideologies of the genuine aristocracy and that of its defenders in the nineteenth century, the F. L. v. d. Marwitz, R. Wagner, Th. Carlyle, Ruskin, and others.

HALLGARTEN, W., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 179-181.

— Studies on Imperialism (Re-feudalization—the Doomsday of Imperialism—Theory of Imperialism in the Past and in the Present). (Will be published by the International Institute of Social Research.)



FRTZ KRAEMER, Guest Worker in the Library of Congress

Grant No. 512 (1941), \$650. To finish the manuscript of a historico-juridical reference book on "The Parliaments of Continental Europe from 1815 to 1914."

In a letter written to the American Philosophical Society in December 1940 the general scope of the planned handbook was described by the present writer in the following terms:

The book is not intended to be a political history of the European Parliaments and no political judgment on the various forms of government or constitutional details will be expressed in it. What is actually lacking is a reference work containing detailed *factual* information, historical as well as juridical, regarding Europe's Legislative Assemblies. The projected handbook is intended to fill this real gap in the existing literature. In it the reader will find a concise but at the same time *detailed* account (1) of the way in which the Parliaments of Continental Europe were elected, (2) of their legislative powers, and (3) of the rôle assigned to them, either by a (written) Constitution or by custom, with regard to the appointment and dismissal of government members (question of "Parliamentary Government").

It has been clear from the very beginning that the task of collecting just this factual information (which today even an experienced student of Constitutional Law, well versed in six or seven European languages, cannot obtain unless he spends a considerable amount of time in detailed research) would not be easy, particularly with regard to the smaller countries.

It seemed, nevertheless, advisable to write the chapters dealing with the smaller nations first, since until now very little has been published in English on the growth and structure of their pre-War Parliaments, whereas the French and Italian Chambers and the German Reichstag before 1914 have been described by English and American writers in a manner decidedly less fragmentary. It was felt, moreover, that American students probably would be particularly interested in the Parliaments of the "progressive" little democracies of Northern and Northwestern Europe and work, so far, has been concentrated on those chapters of the manuscript which deal with the Low Countries (Holland, Belgium) and Scandinavia.

Actually the difficulties in collecting the data and facts regarding the pre-War Parliaments of these countries were even greater than foreseen.

Contrary to what might have been expected, it was comparatively easy to find enough source material on European Legislatures in

American libraries. The various libraries of Columbia University (New York), the New York Public Library, and, above all, the Library of Congress are unusually well equipped in this respect. In the latter, for instance, one will find the Parliamentary Records of virtually all European countries including even a set of the Protocols of the old Swedish Four-Chamber Parliament. The official statistics and statistical yearbooks (electoral statistics) of those countries also can be obtained in Washington without difficulty. With the help of the Library of Congress' Union Catalog, it is easy, moreover, to order from any library in the country such books as may be unobtainable in the Capital.

The real difficulties concerning the handbook arise from the nature of the subject matter itself. The following specific examples will convey a better idea of this than any generalized theoretical explanations:

I. The Swedish Parliament (Riksdag) until 1866 was composed of 4 Chambers (Nobility, Clergy, Burghers, Peasants). The right to participate in the elections to the Peasant Chamber belonged, since 1810, to the peasant owners of crown farms (krono-hemman), tax farms (skatte-hemman) and of the so-called "tax-feudal" farms (skatte-frälse-hemman). Owners of ordinary feudal farms (frälse-hemman) were granted the franchise in 1835, and in 1845 it was provided that henceforth all farm owners (hemmanägare) belonging to the Peasantry would be entitled to vote, which simply meant that from 1845 onward even the owners of "higher feudal" farms (ypperligt frälse) were admitted to the polls.

It is obvious that nobody can possibly understand the actual significance of the above provisions (Art. 15 Organic Law of the Riksdag) unless he is well acquainted with the Swedish system of land classification as it prevailed in those days. Having developed gradually through the centuries, in close connection with complicated changes in the taxation and other laws of the country, this system was far from being simple or logical and to explain it to a modern and foreign reader in a language that is not Swedish constitutes a problem in itself, particularly if the explanation has to be brief and at the same time thoroughly accurate. It may be sufficient to mention some of the difficulties involved:

- 1) The term crown farm "owners" used in Art. 15 of the Organic Law of the Riksdag was incorrect. All the crown farm "owners" were nothing

but hereditary leaseholders, a fact that gave rise to some discussion and eventually led to a change in the wording of that article.

- 2) The term "hemman" is ambiguous; it may mean a measure of land, a farm in general, or a special type of farm ("assessed" farm). Since in the Organic Law of the Riksdag it was undoubtedly used in the latter sense, it followed by implication that owners of non assessed farms were not entitled to vote, though little or nothing is said on this point by virtually all Swedish writers.
- 3) The provision that only persons belonging to the Peasantry (Allmogen) be allowed to participate in electing members of the Peasant Chamber was vague, since it was doubtful whether the term Allmogen included members of the gentry, i.e., persons who though not belonging to the nobility were nevertheless of a higher social standing than the Peasantry proper. It was also never quite clear whether farm owners who were at the same time inn-keepers or miners could be reckoned among the "Peasantry."
- 4) When in 1835 the franchise was granted to the owners of feudal farms (frälse-hemman) this extension was meant to include owners of the so-called "feudal tax" farms (frälsekatte hemman) but not those of the "higher feudal" farms (ytterligt frälse), though this was not expressly mentioned.
- 5) According to the Organic Law of the Riksdag only "besuten" peasants were entitled to vote. The term "besuten (possessing) peasant" was a technical term referring to a peasant owning landed property of a certain minimum size but until this size was actually defined by a Royal Decree (1827) it was not clear what exactly it ought to be. The whole problem was further complicated by the fact that according to all available sources non-besuten peasants, in clear violation of the Law, were actually admitted to the polls in many cases.

All these various problems are by no means purely theoretical. As long as the Four-Chamber Parliament existed (until 1866) there were no electoral statistics. Nor have any such statistics ever been compiled, even tentatively, by any one of the many authors dealing with the Four-Chamber Riksdag (see, for instance, the standard work *Sveriges Riksdag*, a series of about twenty impressive volumes published a few years ago on the occasion of the Riksdag's five hundred year jubilee). In order to give a precise answer to the very important question of whether the Peasant Chamber represented the whole rural population (except the Nobility and Clergy) or only a section or sections of it, it was absolutely necessary, therefore, to ascertain exactly who was admitted to the franchise and who was not. This done, it proved even possible to obtain fairly detailed figures, regarding the rural franchise, by indirect methods, i.e., by using the available data on the kind and distribution of landed property, the movement of the rural population, and the

number, age, and sex of those engaged in agriculture. If the planned handbook is published, it will thus contain a number of statistical charts and tables concerning the rural franchise in Sweden which cannot be found anywhere else. Everyone familiar with this kind of work will understand, however, that the elaboration of these tables alone required more than five weeks.

II. In Belgium, between 1848 and 1894, nobody was entitled to vote who did not pay at least twenty florins of direct taxes per annum. The consequence was that any considerable augmentation of the tax rates automatically led to an increase in the number of persons qualified to vote, whereas the number of voters fell when these rates were lowered.

In 1879, for instance, the Liberal Majority in the Belgian Parliament voted a law providing that henceforth no "Servant Tax" be paid by any employer with regard to servants who were his relatives. A great number of Catholic priests whose "servants" actually were their nieces, sisters or cousins who kept house for them lost their right to vote as a result of this change in the taxation laws. This was exactly what the Liberals had foreseen and desired.

It is clear that in regard to countries where the electoral and fiscal systems are as closely connected one cannot very well describe the former without giving at the same time a more or less detailed account of the latter. It is obvious also that, as far as these countries are concerned, all amendments to the taxation laws must be carefully examined as to their possible repercussions upon the number of voters and the composition of the electorate, and that whenever such repercussions have occurred, they must be mentioned and briefly analyzed. In a reference book, all this, of course, has to be done in a very condensed form, perhaps on a few pages, but the amount of research behind almost every word of these often highly technical explanations and comments can hardly be guessed from the number of pages they cover.

HANS J. MORGENTHAU, University of Kansas City

Grant No. 467 (1940), \$460. The relationship between the political philosophy of liberalism and foreign policy, with special reference to the basic ideas of pre- and post-World War foreign policy.

If one probes deeper into the causes for the failure of liberal foreign policy, one realizes that its inherent weaknesses, as outlined

in a preceding report, have their roots in the inherent weakness of the modern mind itself. More particularly, it is the modern conception of reason, its relation to the irrational forces of evil, and its functions in the social world, which is in the last analysis responsible for the general misdirection as well as for the particular failures of liberalism in foreign affairs.

The philosophy of liberalism is founded upon a rationalistic conception of world and man. Rationalism substitutes for the concept of a theological world, whose divine government is above human understanding as well as action, the concept of an inherently rational world of which man is a part and which he is able to understand and act upon. From this fundamental concept rationalistic philosophy draws three conclusions: first, that the rationally right and the ethically good are identical; second, that the rationally right action is of necessity the successful one; third, that education leads man to the rationally right, hence good and successful action.

This philosophy has failed to understand its object in three fundamental respects. It has failed to understand the nature of man; the nature of the world, especially the social world; and, finally, the nature of reason itself.

The assertion that man is a rational being has a dual meaning. It means, on the one hand, that man by way of reason is capable of understanding himself and the world. It means, on the other hand, that man is capable of acting according to his understanding, that there exists, in other words, at least a potential correspondence between knowledge and action. Both meanings are open to question. The Age of Reason has extended the frontiers of knowledge immensely and has lightened the burden of living for man. Yet it has not lightened the burden of life. It has discovered the causes of many isolated things. But it has not even searched for a meaningful connection of all those isolated things, nor for the nature of them, let alone their purpose and value for man. The problems of life and death, necessity and chance, matter and sense, man and nature, are as unsolved as ever.

The rationalistic approach to the social world is founded upon the latter's identity with physical nature. Nature becomes the model of the social world and the natural sciences the image of what the social sciences one day will be. This analogy is, however, mistaken for two reasons. On the one hand, reason is unable to under-

stand both spheres with the same degree of generality and abstractness. On the other hand, human action is unable to mold both with the same degree of technical perfection.

The reason of rationalism is a goddess, throning immovable over man and things. She is today what she has always been and always will be, identical with herself regardless of time and place. She is the sole guide of man. Above other motivating forces, she governs in splendid isolation and with assurance of final victory. The entire task of man reduces itself to exhausting the logical possibilities of rational premises. Evil, then, is a mere negative quality. It can only be conceived as lack of reason and is incapable of positive determination based upon its own intrinsic qualities. It is nothing but an accidental disturbance of the order of the world, sure to be overcome by a gradual development towards the good.

This picture bears no semblance to reality as revealed by the pre-liberal tradition of western thought as well as by modern epistemology, psychology, and sociology of knowledge. Reason is like a light which by its own inner force can move nowhere. It must be carried in order to move. It is carried by the irrational forces of interest and emotion to where those forces want it, regardless of what the inner logic of abstract reason would require. Its course is furthermore determined by the strength of hostile forces which, as passion, lust for power, and the like, are a permanent element of human existence.

Hence, the appeal to reason pure and simple will not produce the good and successful action, nor will the dissemination of knowledge through education produce it. Since the triumph of reason depends upon the relative strength of opposing irrational forces, social reform must aspire toward creating a balance of power, favorable to reason, among the irrational forces which compete for the control of human action. Out of the inevitability of the struggle between those opposing forces, whose outcome within the span of human life is insecure, there arises the tragic sense of life, which permeates all pre-liberal thought and of which the liberal age is so completely void.

Liberal policy, in both domestic and international affairs, has been largely ineffective because, nourished by the philosophy of rationalism, it has misjudged the nature of reason as well as its social function and has completely overlooked the autonomous existence of evil forces of which the lust for power stands out. Po-

litical philosophy, jurisprudence, legal institutions, and political actions in the liberal age show uniformly the marks of this misconception.

MORGENTHAU, HANS J., 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 224-225.

## CLASS IV. HUMANITIES

### ETHNOLOGY

H. G. BARNETT, University of Oregon

Grant No. 452 (1940), \$200. An analysis of the factors and processes involved in cultural change.

A summer was spent with the Tsimshian Indians of northern British Columbia studying the effects of the meeting of their culture with that of Western European civilization from the time of the first effective contacts near the beginning of the nineteenth century until the present time. The objective was to define consistent patterns of reaction by the natives and their culture to the impingement of Caucasian ideologies and behaviors. The method was to obtain detailed and intimate accounts of individual life histories, together with opinions, judgments and personal observations bearing upon the acceptance or rejection of newly introduced traits and ideas. Characteristic responses appear with sufficient regularity in these accounts to warrant our treating generalizations about them as working hypotheses in the study of cultural change. The conclusions drawn from the data can be summarized as follows.

(1) The processes of change in cultural material reveal clearly that all traits are characterized by at least four attributes: form, meaning, function, and an operating principle. For any one trait the interrelationships between these aspects of it are unstable and variable—a fact which appears only under conditions of change.

(2) Given certain circumstances, it is possible to define constant relationships between the attributes of a trait. For example, the form is consistently the compelling attribute for the assignment of others. It regularly over-rides other considerations in determining meaning and function; i.e., some newly introduced thing which looks or feels like a familiar thing will be given the same meaning and function regardless of what these were in the introducing culture.

(3) This brings it about that the members of two contacting cultures are habitually resistant to making or accepting cross-cultural substitutions of traits and behaviors when these, as is most often the case, are overtly unlike, no matter how certainly they may be shown to perform equivalent functions in the two cultures. There is a psychological block here, and this is the reason for the failure to integrate newly introduced traits, and hence the ultimate cause of the internal frictions and conflicts resulting in the decay so often noted for native groups laboring under the pressure of an engulfing culture.

(4) But this process of functional substitution is the very essence of invention, which takes place in one of two ways: by redirecting a well known principle used in a familiar functional context so that it serves in another and heretofore unrealized functional context; or by applying a new principle to substitute for the traditional one used in a familiar functional context.

(5) As this suggests, not only the members of two contacting groups, but those within a single culture as well habitually do not make functional equations of traits and behaviors. Form is determinative of function and meaning. Hence the rarity of the inventor, for his essential attribute in his ability to cut the tradition-tied knot of form, meaning, and function.

(6) There is an indicated differential between the resistance to change as manifested in the sphere of ideas (ideological patterns) on the one hand, and motor, kinesthetic and physical orientation patterns on the other, the former being more fluid and amenable to change than the latter. That is, it has appeared easier for the Tsimshian to recast their conceptual framework than to modify their eating or working habits. Even though allowance is made for their relatively "materialistic" existence there remains a strong suggestion of the ultra-conservative character of muscular patterns.

(7) Memory plays an important rôle in cultural change. This is so because retention and recall are influenced by the cultural background of the subject; he remembers the aspects and salients which he has been conditioned to remember; he even apprehends them in this light. And insofar as cultural change is concerned the Indian in accepting a newly introduced trait has frequently distorted it in a characteristic manner in accordance with this conditioning, even though he considered himself a slavish imitator.



(8) There are certain individuals who have a more pronounced predisposition for cultural change than others. They may be characterized as individuals who have not achieved a complete or binding adjustment with their culture. Into this category fall the normal run of the "younger generation," but also the socially unadjusted or maladjusted, the suppressed and frustrated, and those who have suffered a social displacement. Specifically, it has been found that half-breeds, widows, orphans, invalids, rebels, and chronic trouble makers have been in the vanguard of those accepting newly introduced patterns.

(9) There are indications that it would not be unreasonable to include inventors in the above categorization. The evidence of the present investigation points to the conclusion that personal conflict is a primary motivation for inaugurating change by invention. In other words, there are good reasons for believing that the inventor is such because he feels, rather acutely and personally, a dissatisfaction with the customary and accepted ways of doing things.

BARNETT, H. G., 1941. Personal Conflicts and Cultural Change. *Social Forces* 20: 160-171.

— 1942. Invention and Cultural Change. *Amer. Anth.* 44: 14-30.

#### CLYDE KLUCKHOHN, Harvard University

Grant No. 544 (1941), \$700. The socialization of forty-eight Navaho Indian children.

This grant was used for two purposes. The first, carried out by Mr. John Landgraf under the supervision of the writer, was in the nature of important background material for the socialization study proper. The second purpose for which the grant was expended was to enable the writer to observe the children between December 28, 1941, and February 1, 1942. It is, of course, impossible to report upon this second research at this time.

The field work done by Mr. Landgraf between July and December, 1941, had two separate aims which could fortunately be simultaneously pursued. One aim was the compilation of detailed and accurate maps of the Ramah, New Mexico, region where the Navaho children in question live. In addition to the four-inch scale maps, other materials were collected which will make possible an exceptionally complete description of the physical environment of the

area and its use by the Navahos. Time was spent in various government agencies abstracting data on soils, vegetation, weather, animal husbandry, and agriculture.

The other and rather separate aim of Mr. Landgraf's work was the collection of material for a study of relations between Indians and whites in the Ramah region. This included historical data, observations on present relations, and detailed study of various pertinent dynamic factors. Records were made of all conversations with whites and later more formal interviews were held with a selected sample, using an adaptation of Roethlisberger and Dixon's methods. Finally, a standardized attitude test was given to a selected group and to as many others as possible. These materials, studied in conjunction with others previously obtained from the Ramah Navaho, will provide the basis for a doctoral dissertation to be submitted to Columbia University by Mr. Landgraf. Since the pressures resultant upon the conflict of cultures are among the more important influences in the personality formation of the children, the significance of this work to the socialization study is obvious. As Mr. Landgraf only returned from the field on December 10, it is not possible as yet to summarize the results obtained from analysis of his data.

### ANCIENT CULTURAL HISTORY

E. A. SPEISER, University of Pennsylvania

Grant No. 471 (1940), \$600. The system of legal procedure in the Nuzi Documents. (This investigation was carried out by Herbert Liebesny.)

In 1925 Dr. Edward Chiera began excavations near Yarghān Tepe, a site about ten miles southwest of Kirkuk, which yielded a large number of very interesting legal documents. The site is the ancient Nuzi, a city in the kingdom of Arrapha. The inhabitants of this settlement were Hurrians. It is a great advantage for the study of these documents that they form a unity both as to time and place. They were all written in Nuzi or nearby towns around 1500 B.C. This is a period during which extensive international relations existed between all the states of the Near East.

As far as we can see from the Nuzi records the law of Nuzi represents a mixture of Hurrian, Babylonian and Assyrian legal elements. An outward sign of the strong cultural influence of the neighboring Semitic countries lies in the fact that the legal records

from Nuzi are all written in Accadian. But the exact extent of the influence of Babylonian and Assyrian law upon the Hurrian law cannot be determined as yet. For this purpose it will be necessary to reconstruct the legal system of Nuzi as far as possible on the basis of the existing records. As these records cover most branches of the substantive as well as the adjective law, a reconstruction of the legal system to a considerable extent seems now possible. Only on the basis of such an extensive study of the legal institutions shall we be able to tell which parts of the law of Nuzi have their counterparts in Assyrian and Babylonian law and which have to be regarded as genuinely Hurrian.

These studies have been concentrated upon the adjective law. The law of procedure in Nuzi follows to some extent the Babylonian or Assyrian pattern but also shows some distinct peculiarities.

In a first brief study we dealt with a procedural means similar to the modern injunction. It enabled the party using it to obtain at least temporary control of fields or movable objects. This institution may have had a counterpart in the Middle Assyrian laws. In a second study the law of evidence was treated. The single means of proof and its application was dealt with as well as the problem of the distribution of the burden of proof and the evaluation of evidence. Further studies will deal with the remaining problems of the law of procedure, especially with judgment and appeal and with the representation of the parties in court by the members of their household or outsiders.

LIEBESNY, HERBERT, 1941. The Oath of the King in the Legal Procedure of Nuzi. *Jour. Amer. Or. Soc.* 61: 62-63.

— 1941. Evidence in Nuzi Legal Procedure. *Jour. Amer. Or. Soc.* 61: 130-142.

## ARCHAEOLOGY, HISTORY OF ART AND ARCHITECTURE

AGNES ADDISON, University of Pennsylvania  
(Now at Randolph-Macon Woman's College)

Grant No. 518 (1941), \$200. Architectural work of William Strickland in Nashville, Tennessee, 1845-1854.

The following Strickland buildings which are still standing in Nashville were studied, photographed, sketched and details measured: (1) the State Capitol, 1845-59; (2) St. Mary's Church, 1845-47; (3) First Presbyterian Church, 1849-51; (4) Belmont,

Acklen house; (5) Bellemeade, Harding house; (6) Lynnwood, built for Thomas E. Stratton, 1845-52; (7) Robert L. Caruthers' house in Lebanon, Tenn. Also the following sepulchral monuments: (1) Walker tomb, 1846; (2) Polk monument, 1850; (3) Kane monument, 1850; (4) Harding vault at Bellemeade, ca. 1852. Material was collected about Burlington, the Elliston house, now torn down and secondary material about residences attributed to Strickland: Melrose, Kingsley, Riverwood, Two Rivers Farm, etc.

In the Tennessee State Library the following primary source material was found: (1) Portfolio of seventy-three architectural drawings; (2) Bound collection of water color drawings, architectural, engineering and landscape, done during trip to Europe in 1838; (3) Building accounts of State Capitol; (4) Reports of Building Commission and Architect of Capitol in *Tennessee State Documents*; (5) Wooden architect's model of tower of Capitol; (6) Eleven articles, "Sketches of Roman Architecture" in *Nashville Orthopolitan*, May 22-June 24, 1846; (7) Essay on "The Three Orders of Architecture—Wisdom, Strength and Beauty" in the *Portfolio*, May 1848. In the Tennessee Historical Society: (1) Minutes of the meetings of the Commission for the Building of the State Capitol; (2) Working drawing of section of basement of west elevation of Capitol (probably drawn by son, Francis); (3) Plan and longitudinal section of a canal from Christiana Creek to Ogle Road surveyed for Chesapeake and Delaware Canal Company, August, September, October 1823.

A great deal of material concerning Strickland and especially the building of the Capitol was gathered from reading Nashville newspapers, 1845-54, in the Nashville Public Library. Of special interest were two articles about designs to which no other references have been found: (1) Monument to the Memory of the Tennessee Volunteers who fell at Monterey, *Republican Banner*, November 18, 1846; (2) New Hotel, *Republican Banner*, October 5, 1848.

The State Bank of Tennessee, now demolished, has been generally attributed to Strickland. By reading the 1834 *Gazetteer* and the *Daily Evening Reporter*, October 10, 1850, it was learned that the building was commenced in 1834 and finished in January 1835 "by the Union Bank . . . under the direction of D. Morrison, Architect. It is a copy on a smaller scale of the United States Bank in Philadelphia, now used as a Customs House. In the year 1843

it was purchased by the Bank of the State of Tennessee." For two reasons this item is of interest: (1) for the additional information about Morrison, whose career is little known, except that he was in charge of repairing and remodelling the Hermitage for Andrew Jackson after the fire of 1834; (2) that Strickland's Bank in Philadelphia was so highly thought of that it was copied nine hundred miles away.

I should like to acknowledge the unwearying aid of the staffs of the Tennessee State Library, the Nashville Public Library and Vanderbilt Library; the helpful suggestions of William Beard of the *Nashville Banner*, and the graciousness of the owners of houses designed by Strickland.

OTTO BENESCH, Harvard College Library, Treasure Department  
Grant No. 541 (1941), \$500. Studies in preparation of a corpus of Rembrandt's drawings.

A research activity of twenty-five years resulted in the accumulation of all the material spread over the different countries of Europe. An amount of more than two thousand photographs was collected and brought over to the United States. The material belonging to the museums and private collections of the United States, Canada and Russia was still lacking. The main part of this material was collected in photographs during last summer and autumn. The photographs of the Rembrandt drawings in Leningrad, Moscow and Kiev were obtained with the help of the Société pour les Relations Culturelles entre l'U. R. S. S. et les pays étrangers. The collecting of the European material is therewith virtually completed.

The manuscript of the scientific catalogue is in progress. The photographs were sent in groups to Allen & Unwin, Publishers, London. Collotype-negatives were taken from them by the printers of the Oxford University Press. The last part of the blue prints has just arrived in this country. The preparatory work for the volumes with the illustrations is almost completed by now.

Valuable information about the studio practice of Rembrandt could be obtained especially from the drawings in the Pierpont Morgan Library, New York. Drawings by pupils of Rembrandt could be traced which were provided with corrections by the master himself. On the other hand, overworkings and completions by later

hands in genuine sketches by Rembrandt could be found out. A drawing attributed to a pupil of Rembrandt could be ascertained as a work of Rembrandt by some lines written in the master's own handwriting. Observations of this kind can only be made by close investigation of the originals.

A study on the works of Rembrandt in the National Gallery in Washington (paintings, etchings and their relations to drawings) will be given as a lecture in the Museum of Fine Arts, Boston.

MARY BUTLER, University Museum, University of Pennsylvania

Grants No. 181 (1937), \$1,800, and No. 497 (1940), \$300. Study of Maya archaeological material, chiefly pottery, from the Chamá district of the highlands of Guatemala.

As reported in the 1939 and 1940 YEAR BOOKS, I spent the archaeological field seasons of those two years excavating in the Maya area in the department of Alta Verapaz in northern Guatemala. In 1939 I worked in the Coban-Carchá region in the west of the Alta Verapaz, in 1940 at Chamá, a famous site on the western edge of the department where it borders the department of Quiché. This field work, correlated with previous research on museum material from western Alta Verapaz and eastern Quiché sites, established a ceramic sequence for the region that should serve as a basis for dating and defining its prehistory.

In 1940 I was given a supplementary grant to use with the remains of my original one for a trip to Guatemala City to prepare for publication the fine pottery, figurines, and jade excavated during the preceding seasons, and left in the country in compliance with Guatemala law. As I was finishing this job, Dr. J. Steward Lincoln, who was doing ethnology in eastern Quiché on a grant from the Carnegie Institution of Washington, invited me to excavate a pottery cache that he and Dr. L. C. Stuart of the University of Michigan had discovered in a street in the village of Nebaj. Nebaj tied in ceramically as well as geographically to the western edge of the territory where I had been working, so I decided to use the remainder of my grant for work there that would include salvage of the pottery and as much general reconnaissance as possible.

Almost all of my time during the five weeks I spent in Nebaj was taken by excavation of the original pottery deposit and a similar

one in another street of the same village. They turned out to be urn burial vaults, revealed by centuries of levelling off the dirt streets of modern Nebaj, built on top of the foot and a half of soil that had accumulated above an early Maya cemetery. In the first excavation, large urns and jars, usually containing the bones of flexed burials, were set close together around and above an extended burial, and were surrounded by small cooking pots and fine dishes and jars. In the second one, a burial urn had been set deep in the stone wall of a dirt-filled platform, and other urns, jars, pots, and fine vessels had been set in a space above it cleared by tearing down the wall.

About three hundred and fifty whole and restorable vessels were found in the two deposits. The pottery from both sites is identical in type and belongs to the Quiché phase of the middle period of the Maya ceramic sequence (Monochrome, Polychrome, Plumbate). It shows in some wares a relationship to the Chamá-Chipal area to the east, and in others connection with the Zacualpa region to the south-east, but has other so far unique traits, such as a black-and-orange negative-painted ware. What reconnaissance work I was able to do showed that the masonry in ruins at Chajul and Nebaj was similar to that previously reported from the Cuchumatanes and the Baja Verapaz.

I should like to take this opportunity to express my gratitude and appreciation for the help and support constantly afforded me in my work by the Carnegie Institution of Washington through the Chairman of the Division of Historical Research, Dr. A. V. Kidder, and the staff of his Guatemala office.

BUTLER, MARY, 1940-41. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 182-184; 1940: 133-135.

EMIL W. HAURY, University of Arizona

Grants No. 299 (1939), \$500; No. 428 (1940), \$500; and No. 514 (1941), \$500. Excavations of pre-Spanish village sites on Forestdale Creek in the Fort Apache Indian Reservation, Arizona.

During the summers of 1939, 1940, and 1941, archaeological work has been conducted in the Forestdale valley, east-central Arizona, with the aid of three grants, Nos. 299, 428, and 514, respectively, from the Penrose Fund of the American Philosophical

Society. The problems, as initially set forth, were: (1) the establishment of the cultural pattern represented in a seventh century pithouse village (Arizona P:16:1); (2) the determination of the extent of the influence exerted on its occupants by two of the principal Southwestern culture divisions—the Anasazi and the Mogollon; and (3) the establishment of a chronological control through tree-ring dating.

These objectives were ultimately expanded somewhat to include the study of both earlier and later occupation evidences in order to assay the interaction of the two above named culture groups over a longer period of time.

In the field season of 1941, excavations were carried on between June 15 and August 9, under a permit from the United States Department of the Interior and the Apache Tribal Council. Cooperating agencies in this endeavor were the Arizona State Museum and the Indian Division of the Civilian Conservation Corps of the Fort Apache Reservation.

The excavations were divided into two phases: (a) the completion of a small pueblo (Arizona P:16:2) dating from about 1100 A.D., and the clearing of several earlier pithouses nearby; and (2) the partial excavation of a pithouse village (Arizona P:16:20), the oldest evidence of occupation so far found in the Forestdale valley, dating from some undetermined period prior to the seventh century.

The pueblo, a compact structure of about twenty-five rooms, is assignable to the early part of Pueblo III and, in the local chronology, it provided the basis, together with surface survey material, for the definition of the Carrizo Phase. Storage pits below this pueblo and adjoining building, a rectangular pithouse with masonry walls, is evidence of an earlier stage of development of a general Pueblo II horizon and called the Dry Valley Phase locally. Still earlier pit structures in the same area have been allocated to Pueblo I, or the Corduroy Phase. All of these are subsequent to the seventh and early eighth century village studied during the first two field seasons, of late Basketmaker III times, and known locally as the Forestdale Phase.

During the Forestdale Phase it has been determined that elements of both the Anasazi and Mogollon Cultures were present and to a certain extent blended. The architecture was strongly northern or Anasazi, while the pottery was primarily of Mogollon vintage.



After this phase the Mogollon elements became submerged in favor of the Anasazi, expressed in the characteristically puebloan development. This culminated in the large Pueblo III and Pueblo IV ruins of the valley, not excavated as yet but roughly datable to the twelfth, thirteenth, and fourteenth centuries.

Results of the excavations in the oldest pithouse village (Arizona P:16:20) so far found in the valley may be summarized as follows:

Houses (6 excavated) were oval to round, 3 to 4 meters in diameter and originally dug into sandstone bedrock to a depth of from .5 to 1.5 meters. No floor features, entrances, benches, or other features were found. These structures were evidently roofed with brush and lacked a dirt or clay cover. A single large structure approximately 10 meters in diameter was also cleared, originally covered with a roof supported by 4 main posts and suggestive in shape and size of the so-called proto-kiva and great kiva of later times. The residents of this village made very little pottery of plain brown ware, and small amounts of red and smudged types, all three being typologically inferior and undoubtedly introductory to the principal local types of the Forestdale Phase.

All other cultural items were rare. These included a few crude chipped tools, metates, manos, stone pipes, likewise evidently introductory to Forestdale Phase forms. Implements of bone were extremely scarce and ornaments of any description were not found. Only one burial came to light, so decayed that identification of the physical features was impossible. Sherds of Anasazi source were absent and a few sherds of Hohokam origin were present. These are not immediately identifiable to any phase of the Hohokam chronology.

Tree-ring dating material was also very limited and prospects of establishing the time of occupancy through this medium are not bright.

The complexion of the culture represented is Mogollon and the relationships are clearly to be sought in villages to the south and east rather than with those to the north.

The cultural history of the Forestdale valley may be summarized as follows, the details for each of the phases to be supplied in later publications:

| Period                 | Phase               | Site <sup>1</sup>           | Dates                                             | Culture                                                                                                                    |
|------------------------|---------------------|-----------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Pueblo IV              | Canyon Creek        | Tundastusa (Ariz. P:16:3)   | 1300-1400 *                                       | Anasazi, with fully developed pueblo architecture. Mogollon pottery techniques well assimilated or submerged by Pueblo IV. |
|                        | Pinedale            | Tundastusa (Arizona P:16:3) | 1200-1300 <sup>1</sup>                            |                                                                                                                            |
| Pueblo III             | Linden <sup>2</sup> | Ariz. P:16:9                | 1125-1200                                         |                                                                                                                            |
|                        | Carrizo             | Ariz. P:16:2                | 1000-1125 *<br><i>1008+x-1123 ±1</i>              |                                                                                                                            |
| Pueblo II              | Dry Valley          | Ariz. P:16:2                | 900-1000                                          | Primarily Anasazi with strong retention of Mogollon ceramic characters.                                                    |
| Pueblo I               | Corduroy            | Ariz. P:16:2                | 800-900                                           |                                                                                                                            |
| Basketmaker III (Late) | Forestdale          | Bear Ruin (Ariz. P:16:1)    | 600-800 <sup>1</sup><br><i>675+x-720 ±10</i>      | Mogollon-Anasazi blend, recognizable in architecture and pottery.                                                          |
| ?                      | (Not named)         | Ariz. P:16:20               | True chronological position not known, but early. | Mogollon; characteristic Anasazi architectural details and ceramics absent.                                                |

<sup>1</sup> Site numbers are those of the Arizona State Museum Survey.

<sup>2</sup> Blackletter indicates phases defined or partly defined by this project.

\* Estimated duration. Actual range of tree-ring dates (for Forestdale valley only) given in *italics*.

HAURY, EMIL W., 1940-41. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 232-233; for 1940: 186-188.

— 1940. New Tree-Ring Dates from the Forestdale Valley, East-Central Arizona. Tree-Ring Bull. 7, no. 2: 14-16.

— 1940. Excavations at Forestdale: Arizona Archaeological and Historical Society. The Kiva, 6, no. 2: 5-8.

— Excavations in the Forestdale Valley, East-Central Arizona. Univ. of Ariz. Soc. Sci. Bull. 12, vol. XI, no. 4: 1-147.

H. O'NEILL HENCKEN, Harvard University

Grant No. 351 (1939), \$500. Preparation of illustrations for reports of Harvard Archaeological Expedition in Ireland (1932-36).

The part of this grant expended during 1941 was applied to the preparation of illustrations for the report on Ballinderry Crannog No. 2. The monograph will be published shortly by the Royal Irish Academy. Ballinderry Crannog No. 2 is situated in central Ireland and has been a site famous in archaeological literature for many years. In 1933, the Harvard Archaeological Expedition in Ireland undertook a complete excavation. The site proved to belong to two periods. The first of these could be dated to the Late Bronze Age, when agricultural and stock-raising settlers from northern Britain built timber and wicker structures on an island in Ballinderry Lake. This site was the first at which habitations of the Late Bronze Age have been discovered in Ireland. This first occupation was ended by a rising of the level of the lake which deposited a deep layer of mud over their settlement.

Subsequently, about the eighth century A.D., the island was re-occupied by people of the Early Christian Period. The eighth century in Ireland is well represented by literary and artistic remains, but heretofore, very little had been known of the habitations of the people. Those who settled at Ballinderry made a kind of fort out of the swampy island by surrounding it with a palisade of heavy timbers. Among the objects recovered were a number of bronze brooches decorated with animal heads. One of these, in which the heads were elaborately enamelled, is the finest specimen of its kind heretofore known.

BETTY H. and HAROLD A. HUSCHER, Colorado Museum of Natural History

Grant No. 557 (1941), \$500. Continuation of archaeological survey of southern and western Colorado.

Investigation was continued in the Rocky Mountain region and adjacent foothills with especial attention to the establishing of a skeleton chronology for various cultural traces previously identified.

A camp site at a spring in the foothills near Denver was tested for stratigraphic possibilities; the test showed a three-stage deposition, all stages artifact-bearing.

Lowest is a limonite-charged black muck layer and above this several feet of marl; these two lower layers contain partially disintegrated pebbles of gneisses and schists. Uppermost is a loose, black, sandy loam deposit, of which the upper half contains cord-marked pottery and thin palette-metates of schist.

An erosion surface marks the contact between the underlying marl and the upper loam. Just below this contact remains of a burial were found, solidly cemented in the marl. The body lay semi-flexed, facing slightly east of south, head southwest; sandstone slabs including utilized slab metates were piled around and over head and body. Stone and bone artifacts were found along the left arm, none of the artifacts definitive.

The body had been attacked by rodents at the time of burial and all but the long bones and the skullcap scattered. Cobblestones and bone fragments distributed in the burial plane suggest interment in a very slight excavation or beneath a surface cairn.

Finding of this burial in an arid climate deposit below an erosion surface offers our first clear clue to conditions in Colorado during the post-Pluvial climatic stage, the pre-Basketmaker archaeological hiatus.

At a spring site in the La Garita Mountains in Saguache County additional test trenches were opened through a buried camp which had been partially explored in 1940. At this site an underlying black swamp muck layer, heavily charged with limonite, in places is capped by a thick limonite bed, in places bevelled by an erosion surface. An excessively wet season raised the water table too high to permit working this bed; thus we were unable to add to our previously obtained short series of crude, percussion-flaked implements.

Above the limonite-bearing beds lie several feet (usually four to six) of a black loam, the lower half of which, in places, may contain limey concretions. Two short series of artifacts have been obtained from the lower part of this loam bed. The upper half of this black loam layer contains a camp of a Basketmaker-like people who lived in open sites, built pentagonal slab-lined storage cists, carefully lined their hearths with cobblestones or paved them with slabs, and who used two distinctive types of dart-sized points, either corner-notched or with a bilobate type base (cf. Pinto Basin, Lovelock Cave). Six similar camp exposures, possibly related though without cists, are known within a half-mile radius, and

short artifact series have been collected. At nearby surface sites are found circular stone house foundations, "Apache-clay" potsherds, and occasional modern Ute points.

In west central Colorado eight additional open sites with slab-lined cists are now known, the artifact series cross-checking rather closely with the southern Colorado sites with the exception of the bilobate based points. The size of the points and the consistent lack of pottery imply for all these sites an age at least equal to that of known early Basketmaker sites.

Continuing exploration for circular stone houses of drylaid masonry shows their occurrence in western Colorado as far north as the Wyoming line. The term "hogan" best describes these buildings since they belong to a widely distributed class of circular dwellings for which the hogan of the modern Navaho may be taken as the type.

Sites mapped this summer show the previously described circular type house directly associated with long-oval houses dug into the sides of hills; again they may be associated with long parallel walls with the intervening space partitioned off by transverse walls. Hilltop sites are known with traces of drylaid stone breastworks surrounding the occupied area. A single true fortress was located, consisting of a tight cluster of curvilinear walled rooms with a circumjacent massive drylaid wall.

The associated material culture series has been lengthened considerably by excavation of selected typical buildings. Arrow-points are invariably small, well made and corner-notched; knives may be un-notched or notched; a single example is corner-tanged. Among bone tools are numerous awls, bone punches for indirect percussion, and a distinctive tool shaped from deer shoulder blade, supposedly used in the separation of plant fibers.

Additional non-Pueblo utility pottery types have been defined from various of these sites; in southern Colorado pastes are indistinguishable from the "Apache-clay" utility wares of the Rio Grande Valley. In western Colorado coarse sand temper and finger-nail marking suggest Promontory affiliations.

The more important inferences to be drawn from the season's work are that the Rocky Mountain region likely was occupied continuously throughout the post-Pluvial drouth period which came to an end some four thousand years ago, and that during the drouth retreat of some of the small nomadic bands must have been upward

into the higher hills instead of downward to regions of more stable rainfall. It follows that the Basketmaker subsistence hunting-gathering culture—substratum from which springs much of Pueblo and Apache-Navaho culture, most of Ute-Paiute—may well have developed autochthonously from the older, big-game hunting, post-Glacial cultures in response to the same severe climatic conditions which witnessed the final extinction of the large post-Pleistocene fauna.

The circular stone houses of the Rocky Mountain region seem to be typologically continuous with the circular pit houses and tripod-framed long-houses of the Columbia River region on the one hand, and on the other to be related in some way with the fortified sites of the Trincheras builders of the Mexican border. In our area they very possibly record the southward passage in late pre-historic times of any of several Southern Athapaskan groups, ancestral to the recent Apache-Navaho bands.

HUSCHER, BETTY H., and HAROLD A., 1942. Athapaskan Migration via the Intermontane Region. *Amer. Antiquity*, **VIII**, no. 1. (In press.)  
— 1942. The Hogan Builders of Colorado. *Southwestern Lore*. (In preparation.)

BENJAMIN D. MERITT, Institute for Advanced Study

Grant No. 466 (1940), \$500.<sup>1</sup> Chemical treatment of a collection of about 20,000 paper impressions of Greek inscriptions.

A collection of about 20,000 paper impressions of Greek inscriptions is now housed at the Institute for Advanced Study in Princeton. These paper impressions, or squeezes, are made of filter-paper which has been moistened and then pounded on the surface of the stones from which impressions are desired. When dry, the squeezes retain a facsimile of the surface, and they form an indispensable library for the study of the epigraphical texts which they record. The value of the collection is enhanced by the fact that many of the stones from which the impressions have been made are now lost, and by the fact that in these times of war one may expect still further destruction of the original monuments.

There has been considerable danger that the fragile documents of the collection in Princeton would be damaged through use, and yet it is obvious that the collection can have its greatest value only

<sup>1</sup> \$116.44 unexpended.

if it is available for the consultation of scholars. Several years ago, Professor Meritt, of the Institute for Advanced Study, and Professor Caley, of Princeton University, undertook to find a method for increasing the durability of these squeezes so that the paper would be made moisture- and water-resistant. The method which they developed depends upon the impregnation of the squeezes with methyl methacrylate resin. This synthetic resin is well adapted to the purpose because it is colorless, transparent, strong, and hard; it is inert chemically, resistant to the action of light and heat, and is not dissolved or otherwise affected by water.

During the course of the year which has elapsed since the making of this grant from the Penrose Fund, the necessary materials have been acquired and the entire collection of 20,326 squeezes has been given the treatment of impregnation. The method consists of spraying the squeezes with a four per cent solution of resin in acetone and ethylene dichloride. The solvents rapidly evaporate and leave the paper impregnated with the solid resin.

It is the judgment of those who have used the squeezes that this treatment with synthetic resin has been entirely successful. The sponsors have published a short account of the method used in *The Journal of Documentary Reproduction*, and have mailed reprints to scholars here and abroad who have similar collections of squeezes at their disposal.

#### EDITH VON PORADA, Pierpont Morgan Library

Grants No. 392 (1939), \$800, and No. 493 (1940), \$800. Catalogue of the cylinder seals in the Pierpont Morgan Library.

This catalogue of the cylinder seals in the Pierpont Morgan Library will make available for further study the largest collection in this country. W. H. Ward had already published 282 cylinders with photographs in *Cylinders and other Ancient Oriental Stones in the Library of J. P. Morgan* (1909); another 219 were published with drawings only, in Ward's work, the *Seal Cylinders of Western Asia* (1910). These were, however, erroneously marked as belonging to the Metropolitan Museum of Art.<sup>1</sup> The rest, num-

<sup>1</sup> Furthermore 7 Cylinders listed in Ward's *Seal Cylinders* under Metropolitan Museum and 6 under J. P. Morgan Library may have belonged to some other collection, since they are not in the Pierpont Morgan Library. On the other hand three seals which were listed under other titles were found in the P. M. L. This seems to indicate some confusion in Ward's notes.

bering some 600 stones, were included with verbal descriptions in Ward's handbook of an exhibition of seals in the Metropolitan Museum (*Metropolitan Museum Handbook No. 12*) for which the Pierpont Morgan Library had lent their material; otherwise they remained unpublished until now. A complete catalogue of the entire collection seemed indicated and has now been made possible by the generous grants from the American Philosophical Society.

In the present catalogue of 1,122 stones, Frankfort's classification, as laid down in his *Cylinder Seals* (London, 1939), has been adopted, minor changes and subdivisions having been made only in the classification of the Cappadocian, Syrian and Assyrian cylinders, where the abundant material of the Pierpont Morgan Library has led to further distinctions.

For the recognition and future classification of peripheral seals, the work on the Cappadocian material may prove to be the most useful. According to the Cappadocian seal impressions (the photographs of which were collected by E. B. Reilly and put at the disposition of the grantee), the Cappadocian seals have been divided into four groups: An "Old Assyrian," "Provincial," "Shaluwanta" and "Syro-Cappadocian" group.

The "Old Assyrian" group corresponds to the style of WM 258,<sup>1</sup> which is related to the impression of the seal of Sargon of Assyria (Edinburgh Museum no. 09.585) and to seals found at Assur (A. Moortgat, *Vorderasiatische Rollsiegel*, Berlin, 1940, nos. 505, 507, 508 and 512).

The "Provincial" group contains Babylonian motives with the addition of alien elements and is exemplified by seals like WM 97. This shows a Babylonian "god with mace" and two worshippers approaching a weather god; the latter wears a typically Cappadocian robe with the shoulder straps converging at the waist (e.g., OIP 27, Plate XLVII 61) and stands on a bull whose horns are carved in similarly typical manner in a thin line above the head (e.g., A. T. Clay, *Letters and Transactions from Cappadocia*, New Haven, 1927, Plate LXXXV, d, the seal of Shaluwanta).

The "Shaluwanta" group, named after the owner of the most characteristic seal of this style, is represented on WM 255. This is considered to be the indigenous style of Cappadocia, corresponding

<sup>1</sup> WM Ward, *Cylinders . . . in the Collection of J. P. Morgan* (for full reference see p. 230).



also to other works of art of that region (e.g., the moulds published by E. Unger in *AfO*, Beiband I, Plate VIII).

The "Syro-Cappadocian" group is represented by seals like WM 246 (for a seal impression of this style, e.g., H. de Genouillac, *Ceramique Cappadocienne*, I, Plate A, 4) and contains designs found on Syrian seals.

The four different groups may denote regional differences of style or a variation in the workshops. They may, however, also correspond to the different ethnic groups of Anatolia, the existence of which is proved by the study of personal names (cf. I. Gelb, *Inscriptions from Alishar and Vicinity*, OIP 27, pp. 16).

This short notice is intended to indicate the general line of discussion which will be more fully treated in the catalogue.

VON PORADA, EDITE, 1941. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1940: 268-269.

#### WILLIAM CAMPBELL ROOT, Bowdoin College

Grant No. 398 (1940), \$500. Studies in the use of metals in pre-Columbian America.

During the summer of 1940, I visited the principal museums of the United States and examined their pre-Columbian collections. Six weeks were spent in the study of the Uhle collections of Peruvian material now at the University of California. Samples were taken from 623 representative metal objects. An attempt was made to obtain samples from objects of known provenience or of some artistic or technical interest.

In the past year quantitative analyses were made of 131 gold, 118 silver, and 18 copper samples, and qualitative spectroscopic analyses were made of about 200 more. Microphotographs were made of 25 polished sections of typical examples of hammering, casting, soldering, welding, and gilding.

A study of the results of the work on Peruvian metal is well under way. The results of the Central American and Mexican work will be taken up later.

The following preliminary outline of the development of Peruvian metallurgy is based on analyses and observations of objects of known site and period. These are chiefly from the Uhle collection, and from W. C. Bennetts' finds in Viru, and Lambayeque. It

closely resembles that worked out by Kroeber and by Lothrop on stylistic grounds.

Since metallurgical knowledge increased very slowly, I have used only the three rough divisions of Peruvian chronology—*Early* (200–800 A.D.), *Middle* (800–1100 A.D.), *Late* (1100–1400 A.D.).

In the *Early Period* the most advanced knowledge of metals was found along the northern coast in the Chimú region. The metals in use were copper and gold. Bronze (copper and tin) and tumbaga (copper and gold) were not known. The gold usually contained from 10 to 30 per cent of silver but this may have been natural alloy. The copper contained no arsenic. Most metal objects were made from hammered sheets. Hollow ornaments were made by beating sheet gold or copper over a mold. Sheet metal was used to cover wood and was fastened by metal tacks. Casting by the *cire perdue* method must have been known as several very complex cast chisel handles have been found. Slugs of metal, chisels, and star shaped club heads are also found. Bimetallic objects may have existed. Soldering was used to some extent. Many ear plugs with rims decorated with soldered beads have been found. Gilded sheet copper was frequently used for ornaments.

This complex metallurgy appears full blown. It has no known antecedents. It differs in many ways from that of Colombia to the north. In Colombia, casting was frequently used, and tumbaga was a common alloy. This was gilded by the process of *mise en couleur*. Microphotographs show that gilding in the Chimú region was done by applying gold leaf to copper sheets. Chimú soldering seems to have been carried out by approximately the same method that Littlefield found was used by the Greeks and Romans. A mixture of gum and some powdered copper salt was applied to the gold surfaces to be soldered. This was slowly heated until the gum charred and reduced the copper salt to metallic copper. The copper combined with the gold to form a lower melting alloy which on cooling formed a strong joint which was almost invisible and had the color of gold. This may well have been the method used to produce the remarkable beadwork of Esmeraldas in Ecuador. There is no evidence that either amalgam gilding or amalgam soldering was used in Peru or anywhere else in America.

During the *Early Period* the Highlands seems to have had a primitive metallurgy that included the use of hammered gold and perhaps copper. The central coastal region about Lima does not

seem to have used metal at this time. The southern coastal region about Paracas and Nasca had hammered gold ornaments of intricate design. Casting and soldering may have been known, but if they were, they were used sparingly.

In the *Middle Period* the working of silver was added to Chimu metallurgy. Large agricultural implements were successfully cast. Gilding with sheet silver was also known. The use of solder increased. Gold, silver, and copper were also used in the Nasca region. Most metal objects there were still made of sheet, although a few cast objects were known. There was a little gilding. Solder may have been used at times. In the Lima region the metallurgy resembled that of Nasca. In the Highlands objects were likewise hammered from gold, silver, and copper. Soldering and gilding do not seem to have been employed there, although too little is known about these regions to make this certain.

In the *Late Period* metal working in the Chimu region involved very complex casting, soldering and cut-out work. Silver increased in use. A few cups and effigy vases are found. In the regions of Lima and Nasca solder was now freely used. Hammered work was more elaborate with many effigy vases, dishes, and cups of gold and silver. Filigree and cut-out work was often seen. Gilding, though, was little used. In the Highlands in the regions conquered by the Incas casting and soldering was common and bronze was freely used.

Conquest by the Incas eventually introduced bronze into the coastal regions, but the Spaniards came before much had been done with it.

The changes in the form of tweezers, axes, knives, earplugs, vases, masks, etc., resulting from the gradual increase in metallurgical knowledge will be studied by Dr. Lothrop. This will permit amplification of the preceding outline.

#### HELLMUT DE TERRA, New School for Social Research

Grant No. 170 (1937), \$2,500. An archaeological survey in Upper Burma.  
Grant No. 561 (1941), \$375. Description of geological and archaeological finds relating to a Megalithic monument in Kashmir, India.

The results of a trial excavation of a Megalithic monument in the Vale of Kashmir constitute the last report of the Yale-Cambridge India Expedition of 1935-36. Geologic data obtained during two field seasons in Kashmir revealed to the writer the presence

of a Postglacial loess formation in which lie buried the remains of a Prehistoric sanctuary dating back probably to a prehistoric Metal Age in India. Judging from the rate of loessic soil formation within historic times, the Megaliths should date back at least 4,000 years. Such a tentative dating appears to accord also with the analysis of the archaeologic finds made in a culture bearing stratum lying about seven feet below the surface. This level was found overlain by a younger stratum containing sherds of the Early Buddhist period of Kashmir (300-400 A.D.). On the other hand there is a deeper prehistoric level with hearths containing polished celts and hand-made pottery with mat and textile design. The latter is unique for India and suggests cultural influences from a Central Asian or Iranian focus. A similar origin is indicated by the Megaliths and associated pottery and tool remains.

The monument itself would indicate that Kashmir in prehistoric times was at one time settled by sun-worshipping folk which could have come only from a northwestern direction, e.g. the Iranian Plateau or Westernmost Central Asia. Sun and fire worship were revived in Kashmir at a much later time when the Indo-Scythian kings introduced Iranian customs. At that time (*ca.* 300 A.D.) Zoroastrian influences gave rise to settlements still bearing names which have reference to the ancient Aryan custom of fire-worship.

DE TERRA, H., 1939 (with PATERSON, T. T.). Studies on the Ice Age of India and Associated Human Cultures. Carnegie Instn. Wash. Pub. No. 493: 1-354.

— 1939-40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 130-131; for 1939: 198-199.

## LANGUAGES AND LITERARY HISTORY

JAMES A. GEARY, Catholic University of America

Grant No. 542 (1941), \$125. Preparation of a phonemic text, with English translation, of a Fox Indian manuscript written in the current Fox syllabic script, which narrates the complete story of Wisahkähä, the traditional Culture-Hero, Trickster, and Dupe of the Fox mythology.

This manuscript comprises 1100 pages of octavo size. Owing to ambiguities arising from the circumstance that the Fox script fails to distinguish certain groups of sounds that are phonemically different, it is necessary to have the manuscript read by a Fox Indian who

understands the content, and to take down phonemically his actual pronunciation. For the translation, the aid of an interpreter is also necessary for anyone who does not know the Fox language, both by eye and by ear, as perfectly as the Fox Indians themselves.

At Tama, Iowa, near which the Fox Indians, along with some Sauks, have a reservation called the "Sac and Fox Reservation," I secured the services of a Fox Indian who happens to be the brother-in-law of the late author of the manuscript, and who, in fact, had a good deal to do with its inception and also had served as informant and interpreter for Dr. Truman Michelson of the Smithsonian Institution, for whom it was composed. This informant had even worked on this manuscript with Dr. Michelson. The latter was about to set to work to edit it when he was suddenly taken from us in 1938. As he had discussed the matter with me, and as he was my preceptor in Algonquian studies, I welcomed the opportunity presented to me in 1941 to complete this task in his memory, with the cooperation of the Smithsonian Institution, custodian of the manuscript, which I have to thank for placing microfilms of the manuscript at my disposal.

The task proved to be of greater proportions than I was able to foresee, owing to my inexperience in this particular phase of Algonquian study. Six weeks of work at six hours a day for six days a week despite 100° weather during a good part of the time, resulted in getting down about one fifth of the text in phonemic script, with translation and explanatory notes. Evidently, the task will require further time; but the experience gained will no doubt accelerate its completion.

Some episodes of this mythological cycle have been published in Jones *Fox Texts* (Publications of the American Ethnological Society, Vol. I), and in Jones *Ojibwa Texts* (same series, Vol. VII [two parts], in Leonard Bloomfield's *Menominee Texts* (same series, Vol. XII), in Leonard Bloomfield's *Plains Cree Texts* (same series, Vol. XVI), and in Leonard Bloomfield's *Sacred Stories of the Sweet Grass Cree* (National Museum of Canada, Bulletin No. 60 [Anthropological Series No. 11]). These stories are also current in other Algonquian languages, and have been fragmentarily recorded. This Fox collection of stories which have hitherto appeared in various languages as scattered episodes may perhaps serve as a consistent basis for the comparison of the versions found piecemeal in

the other Algonquian languages. Perhaps, even, a similar complete narrative may yet be obtained from the older people speaking these other languages.

SAMUEL N. KRAMER. University Museum, University of Pennsylvania, and Oriental Institute, University of Chicago

Grant No. 24—Johnson Fund (1940), \$1,800, and No. 29—Johnson Fund (1941), \$1,800. Copying of Sumerian literary material in the Nippur Collection of the University Museum and reconstructing the Sumerian literary compositions.

This year saw the continuation of the study and analysis of the contents of the six hundred and seventy-five uncopied Sumerian literary pieces in the Nippur Collection of the University Museum. Efforts being concentrated mainly on the one hundred and seventy-five tablets and fragments inscribed with the Sumerian mytho-epical material, preliminary transliterations and translations were prepared of the texts of twenty-three epics and myths. A detailed outline of this work is presented in Excursus B of my *Sumerian Literature*, now in press.

At the same time a definitive edition of *Inanna's Descent to the Nether World*, one of the most important and significant Sumerian myths, was prepared; it consists of (1) Introduction. (2) Transliteration. (3) Notes on Transliteration. (4) Translation. (5) Notes on Translation. (6) Plates (ten plates of photographs and copies of the Sumerian originals). This edition, which will supersede all previous and scattered studies, forms the major part of my *Sumerian Literature*.

As a direct result of the preliminary translations of the Sumerian epics and myths it became possible to prepare an introductory survey of the Sumerian cosmogonic theories and concepts as current in the third millennium B.C. Sumerian cosmogony has remained practically unknown to this day; whatever little was known was surmised from the modified, redacted, and in a sense garbled versions of the Semitic Babylonians who followed the Sumerians and who used the Sumerian cosmogony as the base for their own creation stories. The significance of the recovery of the Sumerian cosmogonic concepts becomes apparent when it is borne in mind that during the major portions of the fourth and third millenniums B.C. the Sumerians were the dominant cultural group in the entire Near

East. Their vast literature, created with the help of their cuneiform system of writing, gave effective expression to their highly developed and remarkably integrated spiritual and religious concepts. Moreover, by the end of the third millennium B.C. Sumer had already ceased to exist as a political entity and Sumerian had already become a dead language. Obviously, then, both because of their content as well as because of their age, the Sumerian cosmogonic theories must have penetrated and permeated the entire Near East. A knowledge of the Sumerian cosmogonic concepts is therefore essential to a proper approach to the cosmogonies of the Near East—and it is not to be forgotten that these Near East cosmogonies form the very warp and woof of the various religious cosmogonies of to-day—for it illuminates and helps to clarify the background behind their origin and development.

This preliminary survey of the hitherto practically unknown Sumerian cosmogony was presented in seven consecutive sessions to the Seminar for Oriental Studies at the University of Pennsylvania. The subject was treated under three heads: (1) *Creation of the Universe*, involving the four creating deities of Sumer. (2) *Organization of the Universe*, involving the creation of numerous deities as well as the appointment of various deities to responsible supervising posts. (3) *Creation of Man*, involving the founding of cultural centers and the establishment of civilization on earth. The final study on Sumerian Cosmogony will go hand in hand with the copying of the literary material in the University Museum and with the final translation of the Sumerian epics and myths.

- KRAMER, SAMUEL N., 1940. Ishtar in the Nether World According to a New Sumerian Text. *Bull. Amer. Schools of Oriental Research* 79: 18–27.  
— 1941. Report of Progress. *Yr. Bk. Amer. Philos. Soc. for 1940*: 287–288.  
— 1942. Sumerian Literature; a Preliminary Survey of the Oldest Literature in the World. *Proc. Amer. Philos. Soc.* 85: 293–323.

EDGAR HOWARD STURTEVANT, Yale Graduate School

Grants No. 456 (1940), \$600, and No. 545 (1941), \$1,000. Supplementation and preparation for publication of materials on Etruscan inscriptions left by the late Dr. Eva Fiesel.

The work on the “Materials for an Etruscan Grammar” has been proceeding according to plan. It can now be said that no chapter of the forthcoming grammar has remained untouched. All

the materials concerning alphabet, phonology, morphology, and what little can be said on syntax, are being coordinated. It is hoped that, in early spring, the final manuscript of the book can be drafted, without any interference from undigested source materials, and that it will be completed by the end of 1942.

Some of the conclusions reached in the course of the work were presented to the Yale Linguistic Club at its October meeting, 1941. Dr. Hoenigswald addressed the Linguistic Society of America on the Etruscan Vowel System at the Annual Meeting. Moreover, he submitted a paper called *Testimonia* on the Etruscan Language to the American Philological Association at its convention.

HOENIGSWALD, H. M., 1941. On Etruscan and Latin Month-Names. *Amer. Jour. Philol.* 62: 199-206.

— 1941. Campanian Inscriptions at Yale. *Amer. Jour. Arch.* 46: 582-586.

### PUBLICATION AND MISCELLANEOUS

#### ANNUAL TABLES OF PHYSICAL CONSTANTS AND NUMERICAL DATA

Hugh S. Taylor, Chairman, American Committee

Grant No. 25—Johnson Fund (1940), \$1,000. Collection of data for the publication of *Annual Tables*.

Owing to the disruption of the work of *Annual Tables* in Paris, the American Committee, with the approval of a group of European Commissioners representing independent friendly countries, decided to continue the work in the United States. American funds formerly contributed towards the publication fund of *Annual Tables* in Europe are now used for their establishment and continuation in this country. Starting with the few grants available at the outset, among which was that of the American Philosophical Society, and by authority of the Division of Chemistry and Chemical Technology of the National Research Council, at its meeting at Atlantic City on September 7, 1941, a campaign for funds was launched which is about to provide the total budget needed. Besides industrial establishments, some research institutes and universities have contributed subsidies to our work.

A Promotion Board in whose name the campaign was launched includes leaders in academic and technical science. The funds contributed are administered through the Committee on *Annual Tables* of the National Research Council, Washington, D. C.



The type of publication decided upon is to be permanent continuation of *International Critical Tables*, in a form permitting current self-insertion of consecutive annual issues. An essential feature is the card-file, at once both an index and a tabulation of fundamental numerical data by substances. The detailed program of division into sections, the provisional project of which is attached to this report, has been submitted to and is under study by the Advisory Editorial Board, created by the Committee, on authorization by the National Research Council.

An appeal has been addressed to members of staffs and heads of departments at universities, colleges, institutes and laboratories for co-operating abstractors: as a result, about 250 volunteer collaborators have been recruited so far and the number is still increasing.

The work is now being distributed to the volunteer abstractors by the Editor. It is expected that the first publications to be issued under the above plans will be forthcoming soon. This achieved, a major international scientific effort, disrupted by the war, will be in process of rehabilitation.

#### BIOLOGICAL ABSTRACTS, University of Pennsylvania

Grant No. 485 (1940), \$2,500. Emergency financing of the journal, *Biological Abstracts*.

This grant has provided for the abstracting (during 1941) of a large amount of biological research literature published in European journals that are no longer available to teachers and research workers in most of the institutions of the United States, which otherwise could not have been recorded in *Biological Abstracts*.

The war has added greatly to the difficulties that scientists have in maintaining effective contact with the progress of science. When the war broke out and the blockade was imposed, the receipt by American libraries of scientific periodicals of Germany, Italy and the invaded nations was either delayed or completely suspended. Subsequently some of this literature began to trickle through by way of Russia, Siberia and the Pacific. The outbreak of hostilities between Germany and Russia shut off this last important means by which European publications can reach this country. European periodicals in small numbers still come to the United States through Lisbon, but this channel is uncertain. The books and scholarly periodicals published in Europe are, in the main, unavailable (in

the original) to workers in the Western Hemisphere. The scientists of Europe are likewise handicapped by the similar unavailability of scientific periodicals published in the Americas.

The abstracting journals remain almost the only means by which scientists of different nations may remain in effective contact. *Biological Abstracts* undertook to compensate, so far as an abstracting journal can compensate, for this deficiency in the means of diffusing knowledge by arranging to abstract the European literature as completely as is possible in these times. Correspondence has been maintained with scientists in neutral nations, particularly in Switzerland, Sweden, and Portugal, with the aim of locating European research publications in the libraries of these nations, and arranging for the abstracting of them there. Some of the European collaborators are still active and a considerable number of current periodicals, apparently no longer available in libraries of the United States, are regularly being abstracted abroad; through the co-operation of the Library of Congress, of the United States Army Medical Library and of the libraries of the Marine Biological Laboratory at Woods Hole and of the United States Department of Agriculture, special arrangements were made for the abstracting of the foreign periodicals obtainable in these libraries.

At the close of the year 1941 some 1,540 periodicals were being regularly abstracted in *Biological Abstracts*. This includes a group of about four hundred, mainly European or Latin American, assigned during the course of this special drive for the better coverage of the foreign-language literature.

During the year 1941, therefore, and largely through the generosity of the American Philosophical Society, *Biological Abstracts* was enabled to carry out, besides its regular and normal program, an additional vitally important service to meet the special conditions arising from the war emergency; it extended its coverage of the world's research literature very markedly, abstracting 24,759 research papers, an increase of 45 per cent over the number abstracted in 1940.

## 6. REPORT OF THE COMMITTEE ON FINANCE

According to the Laws of the Society, the Committee on Finance consists of the President and the Treasurer, *ex-officio*, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April.

Chapter V, Articles 3 and 4 of the Laws read:

"The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

"The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget."

During the year 1941-42, the Committee on Finance consisted of Marshall S. Morgan, *Chairman*, Morris Duane, Thomas S. Gates, Edward Hopkinson, Jr., John Story Jenks, Charles J. Rhoads,

J. Henry Scattergood and Roland S. Morris, *President*. Edwin G. Conklin, *Executive Officer*, sat with the Committee.

The members of the Committee meet regularly once a month from January to June and from October to December with occasional special meetings.

## REPORT OF THE TREASURER

### GENERAL AND SPECIAL FUNDS

There are twenty-two funds in the keeping of the Society. Only four of these are unrestricted in the uses to which their income may be applied "for promoting useful knowledge;" three specify a primary purpose, after which any balance may be used for general purposes; fifteen are restricted to specific uses, eleven of these being for the purchase of books for the Library. These funds and the manner and purpose of their establishment are listed alphabetically below.

#### ASSOCIATED FUND

Created as of December 31, 1939, in accordance with a resolution adopted by the Committee on Finance, December 5, 1939, with the approval of Legal Counsel. All assets held in the Balch International Law Library, Boyé Library, Brush Endowment, Carlier Library, Franklin Library, Jefferson Library, Lewis, Magellanic, Michaux, Norris Library, Phillips Library, Proud Library, Seybert Library and Tilghman Library Funds, were transferred to the Associated Fund at their market value as of December 31, 1939, and each contributing fund was assigned a proportionate interest in the Associated Fund based on the value of assets contributed.

#### BALCH INTERNATIONAL LAW LIBRARY FUND

Founded by Thomas Willing Balch, Esq., of Philadelphia, October 13, 1911, with an initial gift of securities valued at about \$700, increased by later gifts to about \$1,600, as a memorial to his father for his part in bringing about the submission of the Alabama Claims to the Geneva Tribunal. A part of the income to be used for the purchase of books relating to the law of nations and such other uses, when thought advisable, as may promote the study of that science; a part, not less than one-half, to be added annually to the principal.

**BOYÉ LIBRARY FUND**

Bequest of \$1,879.21 by Professor Martin Boyé, of Coopersburg, Pa., who died March 5, 1909. By resolution of the Society, December, 1910, the income to be expended in the purchase of books, preferably on chemistry and geology.

**BRUSH ENDOWMENT FUND**

Gift of \$10,000 by Charles Francis Brush, LL.D., of Cleveland, Ohio, November 24, 1914. Income to be used for the general purposes of the Society.

**BUILDING FUND**

Created by deed of trust dated June 4, 1900, Girard Trust Company, depository and trustee. All money or property which shall be designated or devoted by any donor, testator or other person, for the acquisition of land or buildings for the Society's use, shall be forthwith paid over, conveyed, or delivered by the Society to the said depository, for the acquisition of land and the construction and furnishing of buildings for the use and occupation of the Society. The present value is \$635,531.36.

**CARLIER LIBRARY FUND**

Bequest of \$5,000 by Auguste Carlier, of Paris, who died March 16, 1890. The income, less 10 per cent which is to be added to the principal, is to be expended for the purchase of books for the Library.

**CARNEGIE LIBRARY FUND**

Gift of \$100,000 by the Carnegie Corporation in 1931. The income to be used for the maintenance of the Library.

**DALAND FUND**

Bequest of the residuary estate of Dr. Judson Daland, of Philadelphia, who died August 14, 1937, approximately \$220,000. The income, less 10 per cent which is to be added annually to the principal, to be used by the Society for research in clinical medicine.

**FRANKLIN LIBRARY FUND**

Established by the Library Committee in May, 1911, from funds derived from the proceeds of the sale in that year of dupli-

cates, formerly the property of Benjamin Franklin, approximately \$3,400. The income to be used for the purchase of books.

#### GENERAL FUND

This fund has been accumulated from various sources through many years; its income is available for the general purposes of the Society.

#### JEFFERSON LIBRARY FUND

Established by the Library Committee on January 20, 1905, from the proceeds of royalties from the publication of manuscripts acquired by the Society through President Thomas Jefferson, approximately \$1,700. Income to be used for the purchase of books.

#### JOHNSON FUND

Established in 1937 when Mr. Eldridge Reeves Johnson removed the restriction on his gift of \$500,000 and changed it to General Endowment until 1957, unless prior thereto Mr. Johnson directs that it be used for some other purpose of the Society. After 1957 it is to become an unrestricted gift. All income to be used for the general purposes of the Society.

#### LEWIS FUND

Gift of \$10,000 made by Mrs. John F. Lewis in 1935 in memory of her husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award. In any year income not so awarded to be added to principal.

#### MAGELLANIC FUND

Gift of 200 guineas by John Hyacinth de Magellan, of London, in 1786, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws. By resolution of the Society, December, 1899, the unexpended annual income, less

10 per cent which is to be added to the principal, may be used for the purchase of books relating to those departments of science in which the premium is annually offered.

#### MICHAUX FUND

Bequest of 92,600 francs by François André Michaux, who died at Vaureal, France, October 23, 1855; for the extension and progress of agriculture, and more especially of silviculture, in the United States. By resolution of the Society, March, 1899, the income, less 10 per cent reserved for reinvestment, to be used for the purchase of books on forestry, etc.

#### NORRIS LIBRARY FUND

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets, presented to the Society in 1815 by Joseph Parker Norris, Esq., of Philadelphia, approximately \$2,100. Income to be used for the purchase of books.

#### PHILLIPS LIBRARY FUND

Bequest of his residuary estate, approximately \$3,410 (December, 1895), by Henry Phillips, Jr., Esq., of Philadelphia, who died June 6, 1895, to which were later added two bequests to him, confirmed and audited October 5, 1903, of \$7,547.54 from the estate of his aunt, Emily Phillips, and of \$42,315.80, being an interest in the residuary estate of his uncle, Henry M. Phillips. Income to be used for the purchase of books on archaeology and philology in accordance with the terms of the bequest.

#### PHILLIPS PRIZE ESSAY FUND

The gift on October 5, 1888, of \$5,000 by Miss Emily Phillips, of Philadelphia, in memory of her brother Henry M. Phillips. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

#### PENROSE FUND

Bequest of one-half of the residuary estate of Dr. Richard A. F. Penrose, Jr., of Philadelphia, who died July 31, 1931, approximately \$3,900,000; by the terms of the bequest this gift to be considered an endowment fund, the income of which only is to be used and the capital to be properly invested.

**PROUD LIBRARY FUND**

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets presented in 1812 by Robert Proud, Esq., of Philadelphia, \$2,500. Income to be used for the purchase of books.

**SEYBERT LIBRARY FUND**

Bequest of \$2,000 by Henry Seybert, Esq., of Philadelphia, who died March 3, 1883. By resolution of the Society, November, 1909, the income to be expended for the purchase of books.

**TILGHMAN LIBRARY FUND**

Bequest of \$200 by Chief Justice William Tilghman, of Philadelphia, who died April 30, 1827. Income to be expended for the purchase of books.

**WOOD MEMORIAL FUND**

Bequest of the residuary estate of Walter Wood, of Philadelphia, who died April 20, 1934, approximately \$150,000, in memory of his uncle, George B. Wood, his cousin, Horatio G. Wood, and his two brothers, Richard and Stuart Wood, all of whom were members of the American Philosophical Society; to be used by the Society first for the construction of a building that shall be adequate for the needs of the Society and if there be any surplus, then the same to be applied to such useful purpose or purposes as the Counsel (sic) and Officers of said Society may determine.



## BUDGET FOR 1942

## ESTIMATED INCOME

*Unrestricted Funds*

|                                            |              |              |
|--------------------------------------------|--------------|--------------|
| General.....                               | \$ 35,994.50 |              |
| Charles Francis Brush Endowment...         | 425.96       |              |
| Johnson Endowment.....                     | 21,557.50    |              |
| Richard A. F. Penrose, Jr., Endowment..... | 149,135.85   |              |
|                                            |              | \$207,113.81 |

*Semi-Restricted Funds*

|                             |           |              |
|-----------------------------|-----------|--------------|
| Magellanic.....             | \$ 210.13 |              |
| François André Michaux..... | 1,999.93  |              |
| Wood Memorial.....          | 10,412.25 |              |
|                             |           | \$ 12,622.31 |

*Restricted Funds**A. Library Funds*

|                                  |           |             |
|----------------------------------|-----------|-------------|
| Thomas Balch International Law.. | \$ 171.27 |             |
| Martin Boyé.....                 | 127.00    |             |
| Auguste Carlier.....             | 527.91    |             |
| Carnegie Library.....            | 3,000.00  |             |
| Benjamin Franklin.....           | 374.50    |             |
| Thomas Jefferson.....            | 141.03    |             |
| Joseph Parker Norris.....        | 175.53    |             |
| Henry Phillips, Jr.....          | 3,440.72  |             |
| Robert Proud.....                | 215.03    |             |
| Henry Seybert.....               | 144.13    |             |
| William Tilghman.....            | 76.69     |             |
|                                  |           | \$ 8,393.81 |

*B. Special Funds*<sup>1</sup>

|                                   |             |                     |
|-----------------------------------|-------------|---------------------|
| Judson Daland.....                | \$ 9,262.00 |                     |
| John F. Lewis Prize.....          | 383.37      |                     |
| Henry M. Phillips Prize Essay.... | 472.75      |                     |
|                                   |             | \$ 10,118.12        |
| Sales of Publications.....        |             | 2,000.00            |
|                                   |             | <u>\$240,248.05</u> |

<sup>1</sup> See Schedule VIII for Building Fund.

## ESTIMATED EXPENSES

|                                    |              |                      |
|------------------------------------|--------------|----------------------|
| Executive Office.....              | \$ 10,500.00 |                      |
| Secretaries' Expense.....          | 2,500.00     |                      |
| Telephone.....                     | 450.00       |                      |
| Insurance.....                     | 2,000.00     |                      |
| Committee on Publications.....     | 20,000.00    |                      |
| Committee on Library:              |              |                      |
| Books and Binding.....             | 5,000.00     |                      |
| Librarians' Salaries.....          | 10,500.00    |                      |
| Rental for Housing of Library....  | 8,700.00     |                      |
| Treasurer's Expense.....           | 10,000.00    |                      |
| Hall Fund.....                     | 2,500.00     |                      |
| Committee on Research:             |              |                      |
| Penrose Fund.....                  | 100,000.00   |                      |
| Johnson Fund.....                  | 19,000.00    |                      |
| Daland Fund.....                   | 8,000.00     |                      |
| Research Expense (Penrose Fund) .. | 500.00       |                      |
| Meetings.....                      | 7,000.00     |                      |
| Miscellaneous.....                 | 10,000.00    |                      |
|                                    |              | <u>\$ 216,650.00</u> |

Balances carried forward from 1941 to  
pay appropriations made under  
the 1941 budget:

|                                 |             |                     |
|---------------------------------|-------------|---------------------|
| Books and Binding.....          | \$ 6,749.32 |                     |
| Publication Expenses.....       | 25,889.81   |                     |
| Research Fund (Penrose Fund)... | 49,886.25   |                     |
| Research Fund (Johnson Fund)... | 7,430.00    |                     |
| Research Fund (Daland Fund)...  | 1,730.00    |                     |
|                                 |             | <u>\$ 91,685.38</u> |

The total book value of the investments and cash held as  
Principal as shown by the Accountants' report is:

|                            |                |                       |
|----------------------------|----------------|-----------------------|
| Unrestricted Funds.....    | \$5,659,018.70 |                       |
| Semi-Restricted Funds..... | 718,327.64     |                       |
| Restricted Funds.....      | 498,163.37     |                       |
| Building Fund.....         | 635,531.36     |                       |
|                            |                | <u>\$7,511,041.07</u> |

The following report of our Certified Public Accountants shows  
income and disbursements in accordance with the method hereto-  
fore followed. The income from funds known as "Restricted"

which are applied to specific purposes is separately recorded in Schedule III. The income from the Wood Fund Personalty and the Wood Fund Real Estate is shown in Schedules IV and V; this income, from the Wood Funds, has heretofore been used to reduce indebtedness incurred in connection with settling certain obligations of the Wood Estate. These have now been paid in full. During the coming year the income will be temporarily added to principal as a fund to provide for unusual maintenance or development of the real estate. The income from the Building Fund, of which the Girard Trust Company is Trustee, is added to principal, in accordance with the trust agreement establishing this fund, except insofar as is required to maintain the Hall. Contributions received from the Carnegie Corporation for Investigation on Methods and Results of Adult Education in Science are kept in a separate account. All other income and all other expenses are consolidated into the General Fund (see Schedule I) so that that Fund, in effect, sets forth the operating income and disbursements of the Society.

During the past year the receipts from the General Fund were:

|                                                                                                                |              |                     |
|----------------------------------------------------------------------------------------------------------------|--------------|---------------------|
| Balance 1/1/41.....                                                                                            | \$ 48,713.33 |                     |
| Income (Consolidated).....                                                                                     | 216,652.55   |                     |
|                                                                                                                |              | <u>\$265,365.88</u> |
| Disbursements (Consolidated).....                                                                              |              | 171,867.31          |
| Balance.....                                                                                                   | \$ 93,498.57 |                     |
| Appropriations for Books and Binding, Publication and Research (not expended but carried forward to 1942)..... |              | 91,685.38           |
| Balance.....                                                                                                   | \$ 1,813.19  |                     |

To increase the income of the Society, \$85,000 has been taken from the unexpended appropriations for temporary investment, the investments being added to the principal of the General Fund so that instead of a cash balance at the end of the year of \$93,498.57, the balance is:

|                                            |             |                    |
|--------------------------------------------|-------------|--------------------|
| Transferred to Principal for investment... | \$85,000.00 |                    |
| Cash.....                                  | 8,498.57    |                    |
|                                            |             | <u>\$93,498.57</u> |

Respectfully submitted,  
 FIDELITY-PHILADELPHIA TRUST COMPANY,  
 TREASURER,  
 MARSHALL S. MORGAN, *President*.

## REPORT OF THE CERTIFIED PUBLIC ACCOUNTANTS

LINVILL &amp; PARRY

*Certified Public Accountants*

Twelve South Twelfth Street, Philadelphia

February 13, 1942

ROLAND S. MORRIS, ESQ., *President*,  
The American Philosophical Society,  
Philadelphia, Pa.

*Dear Sir:*

## GENERAL AND TRUST FUNDS

We have examined the accounts of the American Philosophical Society for the year ended December 31, 1941, as contained in the records of the Treasurer, the Fidelity-Philadelphia Trust Company. The appended statements, Schedules I to VII inclusive, are in accordance with these records.

We have examined paid cancelled checks and vouchers in connection with disbursements in the various funds except the Wood Fund Real Estate Income Account, as to which we have accepted the cash records of the Fidelity-Philadelphia Trust Company as agent, without any further examination. The cash in bank at December 31, 1941, as summarized in Schedule VI, has been verified.

We have examined into the changes during the year in the investments in all of the funds. We examined the perpetual and other fire insurance policies carried as an investment in the General Fund, and obtained detailed statements from the Fidelity-Philadelphia Trust Company, the Girard Trust Company, and The Pennsylvania Company, etc., showing at December 31, 1941, the bonds, stocks, real estate and other investments held by them as agents or trustees for the Society, thus satisfactorily accounting for all of the investments of the Society as called for by the records at December 31, 1941.

The investments composing the various funds at December 31, 1941, as summarized in the appended statement (Schedule VII) are at book value, which, in all funds except the Associated Fund, is as follows: Bonds and Mortgages at par or face value to January 1, 1940, and at par or cost, whichever is lower, for subsequent purchases; Stocks at cost when purchased or at inventory value when received as gifts or bequests; and Real Estate at amount of fore-

closed mortgage plus costs of acquisition and subsequent improvements, and appraised or assessed value when acquired as gifts or devises. The Associated Fund investments are at cost. We have not determined the current market value of any of the investments of the Society.

Income due for the year from the investments has been received and recorded on the books prior to December 31, except as follows:

General and Other Trust Funds:

|                                                   |            |
|---------------------------------------------------|------------|
| Bond Interest in Default.....                     | \$1,425.00 |
| (Including \$1,175.00 in default January 1, 1941) |            |

Carnegie Library Fund:

|                                                 |          |
|-------------------------------------------------|----------|
| Delinquent Mortgage Interest.....               | 1,341.67 |
| (Including \$941.67 in default January 1, 1941) |          |

---

\$2,766.67

We do not list as in arrears, deferred interest originally due from November 1, 1938 to November 1, 1940 inclusive, on issues of the Lehigh Valley Railroad Company, which issues are subject to extension plan and agreement, dated August 25, 1938, under which 75 per cent of the interest has been deferred and only 25 per cent paid.

Comprehensive tests have been made of the income receivable from other sources, except as to real estate, for which we have not examined leases, rental statements or other data in connection with income recorded as being received.

### BUILDING FUND

#### *Girard Trust Company, Trustee*

We have examined statements submitted by the Girard Trust Company, Trustee, of the Building Fund for the year ended December 31, 1941, have examined the records in the Society's office of subscriptions or pledges to the fund, and have prepared the appended statement of Cash Receipts and Disbursements and Summary of the Assets for the year—Schedules VIII and IX.

The cash and investments are in accordance with a statement obtained by us from the Girard Trust Company, Trustee, setting forth in detail the assets in their possession at December 31, 1941. All of the investments are at par value except stocks, which are at cost, with real estate (participations) at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements.

We have not determined the present value of any of the investments, or the collectibility of the unpaid pledges to the fund.

We have examined into the changes during the year in the investments, and have accounted for all income due except delinquent mortgage interest \$5,122.96, of which amount \$2,938.58 was delinquent January 1, 1941. As explained under General and Trust Funds, we do not list as in arrears interest deferred on bonds of Lehigh Valley Railroad Company.

Respectfully submitted,

LINVILL & PARRY,

*Certified Public Accountants.*

## SCHEDULE I

## CASH RECEIPTS AND DISBURSEMENTS

*Year ended December 31, 1941*

## GENERAL FUND

*Principal Account*

Balance, January 1, 1941 ..... \$ 2,473.75

## Receipts:

## Investments Sold or Redeemed:

|                                                       |              |
|-------------------------------------------------------|--------------|
| U. S. Government Bonds (\$20,000.00) . . . . .        | \$ 20,537.50 |
| Public Utility Bonds (\$54,000.00) . . . . .          | 56,282.11    |
| On Account of Mortgages . . . . .                     | 5,300.00     |
| Fine Arts All Risks Insurance (one year's charge) . . | 1,205.30     |
| Satisfaction Fee . . . . .                            | 1.00         |

## Walter Wood Real Estate Principal Account:

|                                                |           |
|------------------------------------------------|-----------|
| Payment on account of advances by General Fund | 50,000.00 |
| Transferred from Income Account . . . . .      | 85,000.00 |

218,325.91\$220,799.66

## Disbursements:

## Investments Purchased:

|                                                |              |
|------------------------------------------------|--------------|
| U. S. Government Bonds (\$85,000.00) . . . . . | \$ 85,000.00 |
| Preferred Stocks . . . . .                     | 30,839.55    |
| Common Stocks . . . . .                        | 90,433.40    |
| Perpetual Fire Insurance Policies . . . . .    | 800.00       |
| Satisfaction Fee . . . . .                     | 1.00         |

207,073.95Balance, December 31, 1941 ..... \$ 13,725.71*Income and Operating Account*

Balance, January 1, 1941 ..... \$ 48,713.33

## Receipts:

|                                                                                                                     |              |
|---------------------------------------------------------------------------------------------------------------------|--------------|
| Income from Investments . . . . .                                                                                   | \$ 38,706.74 |
| Girard Trust Company Building Fund Reimbursement for alterations and furnishing of Society's building, etc. . . . . | 3,791.30     |
| Sale of Publications . . . . .                                                                                      | 2,329.01     |
| Royalties on W. B. Scott's book, "History of Land Mammals in the Western Hemisphere" . . . . .                      | 279.54       |
| The Henry LaBarre Jayne Lecture Foundation . . . .                                                                  | 200.00       |
| Woods Hole Oceanographic Institution . . . . .                                                                      | 300.00       |
| Sale of Microfilms . . . . .                                                                                        | 234.92       |
| Refund—Penrose Research Fund Grant . . . . .                                                                        | 498.33       |
| Refunds and Cancellations—Insurance . . . . .                                                                       | 212.13       |

## Transfer of Income from Trust Funds:

|                                                      |              |
|------------------------------------------------------|--------------|
| Richard A. F. Penrose, Jr., Endowment Fund . . . . . | \$146,736.75 |
| Johnson Endowment Fund . . . . .                     | 13,000.00    |
| Judson Daland Fund . . . . .                         | 7,000.00     |
| Carnegie Library Fund . . . . .                      | 2,908.43     |
| Charles F. Brush Endowment Fund . . . . .            | 455.40       |

170,100.58216,652.55\$265,365.88

## Disbursements:

|                                                                        |              |             |
|------------------------------------------------------------------------|--------------|-------------|
| Salaries—Executive Office.....                                         | \$ 10,500.00 |             |
| Salaries and Pension—Librarian and Assistant Librarians.....           | 9,982.50     |             |
| Secretaries' Expenses.....                                             | 2,691.25     |             |
| Telephone.....                                                         | 434.78       |             |
| Publication Expenses.....                                              | 19,945.63    |             |
| Royal Society of London.....                                           | 10,000.00    |             |
| Books and Binding.....                                                 | 5,216.06     |             |
| Camera Expenses.....                                                   | 594.14       |             |
| Insurance.....                                                         | 1,346.31     |             |
| Meetings.....                                                          | 5,991.24     |             |
| Hall Expenses.....                                                     | 2,792.07     |             |
| Hall Equipment, Alterations and Furnishings.....                       | 3,903.30     |             |
| Library Rental (Drexel Building).....                                  | 8,700.00     |             |
| Investment Counsel Fees.....                                           | 2,500.00     |             |
| Auditing Fees.....                                                     | 925.00       |             |
| Treasurer's Expense.....                                               | 40.03        |             |
| Research Fund Grants:                                                  |              |             |
| Penrose Fund.....                                                      | \$61,294.41  |             |
| Penrose Fund: Committee on Education and Participation in Science..... | 2,000.00     |             |
| Johnson Fund.....                                                      | 15,323.34    |             |
| Daland Fund.....                                                       | 6,270.00     |             |
|                                                                        | <hr/>        | 84,887.75   |
| Research Expenses.....                                                 | 437.56       |             |
| Insurance and Postage.....                                             | 10.74        |             |
| Treasurer's Commissions.....                                           | \$ 6,769.27  |             |
| Agent's Commission (Girard Trust Company, Carnegie Fund).....          | 113.78       |             |
|                                                                        | <hr/>        | \$ 6,883.05 |
| Charged Other Funds.....                                               | 5,914.10     |             |
|                                                                        | <hr/>        | 968.95      |
| Transfer to Principal Account.....                                     | 85,000.00    |             |
|                                                                        | <hr/>        | 256,867.31  |
| Balance, December 31, 1941—General Fund.....                           | \$ 8,498.57  |             |

## COMMITTEE ON EDUCATION AND PARTICIPATION IN SCIENCE

## Grant from Carnegie Corporation of New York

|                                                              |             |              |
|--------------------------------------------------------------|-------------|--------------|
| Balance Unexpended January 1, 1941.....                      | \$ 8,120.61 |              |
| Receipts:                                                    |             |              |
| Carnegie Corporation of New York....                         | \$10,500.00 |              |
| Grant from Penrose Fund, American Philosophical Society..... | 2,000.00    |              |
| Sale of Pamphlets.....                                       | 147.60      |              |
|                                                              | <hr/>       | 12,647.60    |
|                                                              |             | \$ 20,768.21 |
| Expended.....                                                | 11,038.04   |              |
|                                                              | <hr/>       | 9,730.17     |
| Balance Unexpended, December 31, 1941.....                   |             | 9,730.17     |
| Total.....                                                   |             | \$ 18,228.74 |



## Note:

The following General Fund appropriations for 1941  
balances are carried forward:

|                                                                             |                                |
|-----------------------------------------------------------------------------|--------------------------------|
| Books and Binding.....                                                      | \$ 6,749.32                    |
| Publication Expenses.....                                                   | 25,889.81                      |
| Research Fund:                                                              |                                |
| Penrose Fund.....                                                           | \$49,886.25                    |
| Johnson Fund.....                                                           | 7,430.00                       |
| Daland Fund.....                                                            | 1,730.00                       |
|                                                                             | <hr/>                          |
|                                                                             | 59,046.25                      |
| Total General Fund appropriations for 1941 balances<br>carried forward..... | <hr/><br>\$ 91,685.38<br><hr/> |

# SCHEDULE II

## SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1941

### TRUST FUNDS—PRINCIPAL ACCOUNT\*

|                                       | Receipts                  |                                 | Disbursements             |                       |                    |
|---------------------------------------|---------------------------|---------------------------------|---------------------------|-----------------------|--------------------|
|                                       | Proceeds from Investments | Transferred from Income Account | Distribution from Estates | Investments Purchased | Miscellaneous Fund |
| Balance 1-1-1941                      |                           |                                 |                           |                       |                    |
| Unrestricted Funds:                   |                           |                                 |                           |                       |                    |
| Johnson Endowment                     | \$49,832.69               | \$136,986.29                    | \$2,080.39                | \$188,899.37          | \$186,654.93       |
| Richard A. F. Penrose, Jr., Endowment | 3,080.80                  | 533,791.79                      | —                         | 537,472.59            | 536,070.95         |
|                                       | \$53,513.49               | \$670,778.08                    | \$2,080.39                | \$726,371.96          | \$722,731.88       |
| Semi-restricted Funds:                |                           |                                 |                           |                       |                    |
| Magallanic                            | —                         | —                               | \$ 23.04                  | —                     | —                  |
| François André Michaux                | —                         | —                               | 219.30                    | 219.30                | 219.30             |
|                                       | —                         | —                               | \$ 242.34                 | \$ 242.34             | \$ 242.34          |

### Restricted Funds:

| Library Funds:                 |             | Receipts                  |                                 | Disbursements             |                       |                    |
|--------------------------------|-------------|---------------------------|---------------------------------|---------------------------|-----------------------|--------------------|
|                                |             | Proceeds from Investments | Transferred from Income Account | Distribution from Estates | Investments Purchased | Miscellaneous Fund |
| Thomas Balch International Law | —           | —                         | \$ 93.91                        | —                         | —                     | \$ 93.91           |
| Martin Boyé                    | —           | —                         | 13.92                           | —                         | —                     | 13.92              |
| Augusto Carlier                | —           | —                         | 57.89                           | —                         | —                     | 57.89              |
| Carnegie Library               | \$ 8,377.25 | \$ 1,352.19               | —                               | 9,729.44                  | \$ 5,100.00           | \$ 5,100.00        |
| Benjamin Franklin              | —           | —                         | 41.07                           | —                         | —                     | 41.07              |
| Thomas Jefferson               | —           | —                         | 15.46                           | —                         | —                     | 15.46              |
| Joseph Parker Norris           | —           | —                         | 19.25                           | —                         | —                     | 19.25              |
| Henry Phillips, Jr.            | —           | —                         | 3,577.29                        | —                         | —                     | 3,577.29           |
| Robert Proud                   | —           | —                         | 23.58                           | —                         | —                     | 23.58              |
| Henry Seybert                  | —           | —                         | 16.80                           | —                         | —                     | 16.80              |
| William Tilghman               | —           | —                         | 8.41                            | —                         | —                     | 8.41               |
|                                | \$ 8,377.25 | \$ 1,352.19               | \$3,866.58                      | \$ 13,599.02              | \$ 5,100.00           | \$3,866.58         |
| Special Funds:                 |             |                           |                                 |                           |                       |                    |
| Judson Daland                  | 1,069.02    | 350.05                    | 1,049.87                        | \$269.30                  | 153.57                | 153.57             |
| John F. Lewis Prize            | —           | —                         | 42.04                           | —                         | —                     | 42.04              |
| Henry M. Phillips Prize Essay  | 219.02      | —                         | 47.28                           | 266.90                    | 50.00                 | 50.00              |
|                                | \$ 9,065.89 | \$ 1,702.24               | \$5,005.77                      | \$209.30                  | \$ 5,303.57           | \$3,008.02         |
|                                | —           | —                         | —                               | —                         | —                     | \$4,160.96         |
| Transferred to Associated Fund | —           | —                         | —                               | —                         | —                     | —                  |
| Associated Fund                | \$ 1,713.11 | \$ 28,919.03              | \$4,150.96                      | —                         | —                     | —                  |
| Totals                         | \$64,892.49 | \$701,400.25              | \$7,328.50                      | \$34,784.00               | \$33,027.51           | \$33,030.21        |
|                                | —           | —                         | —                               | \$269.30                  | \$773,890.54          | \$761,070.30       |
|                                | —           | —                         | —                               | —                         | —                     | \$12,820.24        |

\* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.

# SCHEDULE III

## SUMMARY OF CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1941

Trust Funds—Income Account\*

### Receipts

|                                            | Balance<br>1-1-41 | Gross<br>Income<br>from<br>Investments | Treasurer's<br>and Agent's<br>Commis-<br>sions and<br>Misc. | Disbursements<br>Trans-<br>ferred to<br>General<br>Fund | Trans-<br>ferred to<br>Principal<br>Account | Total        | Balance<br>12-31-41 |
|--------------------------------------------|-------------------|----------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------|--------------|---------------------|
| <i>Unrestricted Funds:</i>                 |                   |                                        |                                                             |                                                         |                                             |              |                     |
| Charles Francis Brush Endowment.....       | —                 | \$ 455.40†                             | —                                                           | \$ 455.40                                               | —                                           | \$ 455.40    | —                   |
| Johnson Endowment .....                    | \$11,761.17       | 20,728.92                              | —                                                           | 13,000.00                                               | \$2,080.39                                  | 15,603.97    | \$16,886.12         |
| Richard A. F. Penrose, Jr., Endowment..... | —                 | 150,579.78                             | —                                                           | 3,843.03                                                | 146,736.75                                  | 150,579.78   | —                   |
|                                            | \$11,761.17       | \$171,764.10                           | —                                                           | \$4,366.61                                              | \$2,080.39                                  | \$160,839.15 | \$16,886.12         |
| <i>Semi-restricted Funds:</i>              |                   |                                        |                                                             |                                                         |                                             |              |                     |
| Magellanic .....                           | \$ 400.68         | 224.68†                                | —                                                           | —                                                       | \$ 23.04                                    | \$ 33.56     | \$ 600.80           |
| François André Michaux .....               | 3,941.24          | 2,138.18†                              | —                                                           | —                                                       | 219.30                                      | 717.07       | 5,362.35            |
|                                            | \$ 4,350.92       | \$ 2,362.80                            | —                                                           | —                                                       | \$ 242.34                                   | \$ 750.63    | \$ 5,963.15         |

### Restricted Funds:

|                                      |             |              |              |            |            |              |              |
|--------------------------------------|-------------|--------------|--------------|------------|------------|--------------|--------------|
| <i>Library Funds:</i>                |             |              |              |            |            |              |              |
| Thomas Balch International Law ..... | \$ 302.14   | 183.12†      | \$ 545.26    | 4.38       | —          | \$ 93.91     | \$ 89.53     |
| Martin Boyé .....                    | 382.37      | 135.77†      | 518.14       | 12.70      | —          | 13.92        | 26.62        |
| Auguste Carlier .....                | 882.22      | 564.40†      | 1,446.62     | 168.62     | —          | 57.89        | 226.51       |
| Carnegie Library .....               | —           | 3,825.45     | 3,825.45     | —          | \$ 917.02  | —            | 3,825.45     |
| Benjamin Franklin .....              | 457.61      | 400.38†      | 857.99       | 256.86     | —          | 41.07        | 287.93       |
| Thomas Jefferson .....               | 324.92      | 150.77†      | 475.69       | 88.60      | —          | 15.46        | 104.06       |
| Joseph Parker Norris .....           | 313.42      | 187.67†      | 501.09       | 38.42      | —          | 19.25        | 371.63       |
| Henry Phillips, Jr. ....             | 6,630.53    | 3,678.55†    | 10,309.38    | 896.20     | —          | 3,577.29     | 4,473.49     |
| Robert Proud .....                   | 513.91      | 229.88†      | 743.79       | 39.81      | —          | 23.58        | 63.39        |
| Henry Seybert .....                  | 356.76      | 154.10†      | 510.86       | 1.80       | —          | 15.80        | 17.60        |
| William Tilghman .....               | 119.44      | 82.00†       | 201.44       | 13.70      | —          | 8.41         | 179.33       |
|                                      | \$10,343.62 | \$ 9,592.09  | \$19,935.71  | \$1,512.33 | \$ 917.02  | \$ 2,908.43  | \$3,866.58   |
| <i>Special Funds:</i>                |             |              |              |            |            |              |              |
| Judson Deland .....                  | 7,710.63    | 10,498.75    | 18,209.38    | —          | 282.89     | 7,000.00     | 1,049.87     |
| John F. Lewis Prize .....            | 401.06      | 409.87†      | 810.92       | 310.00     | —          | 42.04        | 352.04       |
| Henry M. Phillips Prize Essay .....  | 1,643.16    | 472.78       | 2,115.92     | —          | 11.82      | 47.28        | 59.10        |
|                                      | \$20,098.46 | \$ 20,973.47 | \$ 41,071.93 | \$1,822.33 | \$1,211.73 | \$ 9,908.43  | \$5,006.77   |
|                                      | —           | \$ 230.64†   | \$ 230.64    | —          | —          | —            | \$ 230.64    |
| Associated Fund .....                | \$36,210.56 | \$195,331.07 | \$231,541.63 | \$2,830.62 | \$5,808.98 | \$170,100.58 | \$7,328.50   |
| Totals .....                         |             |              |              |            |            |              | \$185,568.68 |

\* Exclusive of: Wood Fund—See Schedules IV and V. Building Fund—See Schedules VIII and IX.

† Income from Investments—Associated Funds Total \$9,225.41.

## SCHEDULE IV

## CASH RECEIPTS AND DISBURSEMENTS

*Year ended December 31, 1941*

## WOOD FUND—PERSONALTY

*Principal Account*

|                                                    |             |                  |
|----------------------------------------------------|-------------|------------------|
| Balance, January 1, 1941.....                      | \$          | 541.44           |
| Receipts:                                          |             |                  |
| Investments sold or redeemed.....                  | \$          | 300.00           |
| Estate of Juliana Wood, deceased.....              |             | 35,000.00        |
|                                                    |             | <u>35,300.00</u> |
|                                                    |             | \$35,841.44      |
| Disbursements:                                     |             |                  |
| Transferred to Wood Fund—Real Estate Principal Ac- |             |                  |
| count.....                                         | \$33,000.00 |                  |
| Legal Services—Estate of Juliana Wood.....         | 2,000.00    |                  |
|                                                    |             | <u>35,000.00</u> |
| Balance, December 31, 1941.....                    | \$          | 841.44           |

*Income Account*

|                                                    |          |                    |
|----------------------------------------------------|----------|--------------------|
| Balance, January 1, 1941.....                      | \$       | 1,075.49           |
| Receipts:                                          |          |                    |
| Income from Investments.....                       |          | 5,437.88           |
|                                                    |          | <u>\$ 6,513.37</u> |
| Disbursements:                                     |          |                    |
| Treasurer's Commission.....                        | \$       | 271.90             |
| Transferred to Wood Fund—Real Estate Principal Ac- |          |                    |
| count.....                                         | 5,000.00 |                    |
|                                                    |          | <u>5,271.90</u>    |
| Balance, December 31, 1941.....                    | \$       | 1,241.47           |

## SCHEDULE V

## CASH RECEIPTS AND DISBURSEMENTS

*Year ended December 31, 1941*

## WOOD FUND—REAL ESTATE

*Principal Account*

|                               |    |        |
|-------------------------------|----|--------|
| Balance, January 1, 1941..... | \$ | 197.22 |
|-------------------------------|----|--------|

## Receipts:

## Transferred from Wood Fund—Personalty:

|                        |             |
|------------------------|-------------|
| Principal Account..... | \$33,000.00 |
|------------------------|-------------|

|                     |          |
|---------------------|----------|
| Income Account..... | 5,000.00 |
|---------------------|----------|

## Transferred from Wood Fund—Real Estate

|                     |          |
|---------------------|----------|
| Income Account..... | 9,000.00 |
|---------------------|----------|

## Sale of Dey and Petty Farms in Middlesex County,

|           |          |
|-----------|----------|
| N. J..... | 3,200.00 |
|-----------|----------|

|  |                  |
|--|------------------|
|  | <u>50,200.00</u> |
|--|------------------|

|  |                    |
|--|--------------------|
|  | <u>\$50,397.22</u> |
|--|--------------------|

## Disbursements:

|                                                      |             |
|------------------------------------------------------|-------------|
| Payments on account of loan—General Fund Principal.. | \$50,000.00 |
|------------------------------------------------------|-------------|

|                                      |        |
|--------------------------------------|--------|
| Commission on Real Estate Sales..... | 160.00 |
|--------------------------------------|--------|

|                                              |        |
|----------------------------------------------|--------|
| Expenses re sale of Dey and Petty Farms..... | 208.40 |
|----------------------------------------------|--------|

|                                            |      |
|--------------------------------------------|------|
| Affidavits re Mercer Co., N. J., Farm..... | 1.50 |
|--------------------------------------------|------|

|  |                  |
|--|------------------|
|  | <u>50,369.90</u> |
|--|------------------|

|                                 |    |       |
|---------------------------------|----|-------|
| Balance, December 31, 1941..... | \$ | 27.32 |
|---------------------------------|----|-------|

*Income Account*

|                               |    |          |
|-------------------------------|----|----------|
| Balance, January 1, 1941..... | \$ | 8,962.95 |
|-------------------------------|----|----------|

## Receipts:

|                              |             |
|------------------------------|-------------|
| Income from Real Estate..... | \$47,122.44 |
|------------------------------|-------------|

|                                               |       |
|-----------------------------------------------|-------|
| Adjustment and Cancellation of Insurance..... | 16.30 |
|-----------------------------------------------|-------|

|                      |       |
|----------------------|-------|
| Refund of Taxes..... | 39.00 |
|----------------------|-------|

|                    |       |
|--------------------|-------|
| Miscellaneous..... | 34.59 |
|--------------------|-------|

|  |                  |
|--|------------------|
|  | <u>47,212.33</u> |
|--|------------------|

|  |                    |
|--|--------------------|
|  | <u>\$56,175.23</u> |
|--|--------------------|

## Disbursements:

|                           |             |
|---------------------------|-------------|
| Taxes on Real Estate..... | \$14,276.00 |
|---------------------------|-------------|

|                  |        |
|------------------|--------|
| Water Rents..... | 461.80 |
|------------------|--------|

|                                         |           |
|-----------------------------------------|-----------|
| Maintenance, Repairs and Insurance..... | 24,760.07 |
|-----------------------------------------|-----------|

|                                                |        |
|------------------------------------------------|--------|
| General Fund Income, Interest on Advances..... | 600.00 |
|------------------------------------------------|--------|

|                                   |       |
|-----------------------------------|-------|
| Fee for Assessment Reduction..... | 83.50 |
|-----------------------------------|-------|

|                             |        |
|-----------------------------|--------|
| Treasurer's Commission..... | 679.03 |
|-----------------------------|--------|

## Transferred to Wood Fund—Real Estate

|                        |          |
|------------------------|----------|
| Principal Account..... | 9,000.00 |
|------------------------|----------|

|  |                  |
|--|------------------|
|  | <u>49,860.40</u> |
|--|------------------|

|                                 |    |          |
|---------------------------------|----|----------|
| Balance, December 31, 1941..... | \$ | 6,314.88 |
|---------------------------------|----|----------|

# SCHEDULE VI

## SUMMARY OF CASH

December 31, 1941

|                                                                                            | Principal          | Income             | Total              |
|--------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|
| <i>Unrestricted Funds:</i>                                                                 |                    |                    |                    |
| General.....                                                                               | \$13,725.71        | \$18,228.74        | \$31,954.45        |
| Johnson Endowment.....                                                                     | 2,240.66           | 16,886.12          | 19,126.78          |
| Richard A. F. Penrose, Jr., Endowment..                                                    | 1,394.78           | —                  | 1,394.78           |
|                                                                                            | <u>\$17,361.15</u> | <u>\$35,114.86</u> | <u>\$52,476.01</u> |
| <i>Semi-Restricted Funds:</i>                                                              |                    |                    |                    |
| Magellanic .....                                                                           | —                  | \$ 600.80          | \$ 600.80          |
| François André Michaux.....                                                                | —                  | 5,362.35           | 5,362.35           |
| Wood Memorial:                                                                             |                    |                    |                    |
| Personalty.....                                                                            | \$ 841.44          | 1,241.47           | 2,082.91           |
| Real Estate.....                                                                           | 27.32              | 6,314.88           | 6,342.20           |
|                                                                                            | <u>\$ 868.76</u>   | <u>\$13,519.50</u> | <u>\$14,388.26</u> |
| <i>Restricted Funds:</i>                                                                   |                    |                    |                    |
| Library Funds:                                                                             |                    |                    |                    |
| Thomas Balch International Law.....                                                        | —                  | \$ 455.73          | \$ 455.73          |
| Martin Boyé.....                                                                           | —                  | 491.52             | 491.52             |
| Auguste Carlier.....                                                                       | —                  | 1,220.11           | 1,220.11           |
| Carnegie Library.....                                                                      | \$ 4,629.44        | —                  | 4,629.44           |
| Benjamin Franklin.....                                                                     | —                  | 560.06             | 560.06             |
| Thomas Jefferson.....                                                                      | —                  | 371.63             | 371.63             |
| Joseph Parker Norris.....                                                                  | —                  | 443.42             | 443.42             |
| Henry Phillips, Jr.....                                                                    | —                  | 5,835.89           | 5,835.89           |
| Robert Proud.....                                                                          | —                  | 680.40             | 680.40             |
| Henry Seybert.....                                                                         | —                  | 493.26             | 493.26             |
| William Tilghman.....                                                                      | —                  | 179.33             | 179.33             |
|                                                                                            | <u>\$ 4,629.44</u> | <u>\$10,731.35</u> | <u>\$15,360.79</u> |
| Special Funds:                                                                             |                    |                    |                    |
| Judson Daland.....                                                                         | 2,584.67           | 9,876.62           | 12,461.29          |
| John F. Lewis Prize.....                                                                   | —                  | 458.88             | 458.88             |
| Henry M. Phillips Prize Essay.....                                                         | 216.90             | 2,056.82           | 2,273.72           |
|                                                                                            | <u>\$ 7,431.01</u> | <u>\$23,123.67</u> | <u>\$30,554.68</u> |
| <i>Associated Fund</i> .....                                                               | <u>\$ 1,753.79</u> | —                  | <u>\$ 1,753.79</u> |
| Totals.....                                                                                | <u>\$27,414.71</u> | <u>\$71,758.03</u> | <u>\$99,172.74</u> |
| On deposit with Fidelity-Philadelphia Trust Company (Treasurer's Account).....             |                    |                    |                    |
|                                                                                            |                    |                    | \$71,758.03        |
| Included among the Trust Funds (Cash) of Fidelity-Philadelphia Trust Co.....               |                    |                    |                    |
|                                                                                            |                    |                    | 22,785.27          |
| Included among the Trust Funds (Cash) of Girard Trust Company (Carnegie Library Fund)..... |                    |                    |                    |
|                                                                                            |                    |                    | 4,629.44           |
|                                                                                            |                    |                    | <u>\$99,172.74</u> |

## SCHEDULE VII

## GENERAL AND SPECIAL FUNDS

## PRINCIPAL

December 31, 1941

|                                                                                                                                                                                                           | Uninvested  |                | Total Funds    |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|----------------|----------------|
|                                                                                                                                                                                                           | Cash        | Invested       | at             | at             |
|                                                                                                                                                                                                           | 12-31-1941  | 12-31-1941     | Book Value     | Book Value     |
|                                                                                                                                                                                                           | 12-31-1941  | 12-31-1941     | 12-31-1941     | 12-31-1940     |
| <i>Unrestricted Funds:</i>                                                                                                                                                                                |             |                |                |                |
| General.....                                                                                                                                                                                              | \$13,725.71 | \$ 870,899.21  | \$ 884,624.92  | \$ 796,805.31  |
| Johnson Endowment.....                                                                                                                                                                                    | 2,240.66    | 516,525.17     | 518,765.83     | 514,020.93     |
| Richard A. F. Penrose, Jr.,<br>Endowment.....                                                                                                                                                             | 1,394.78    | 4,242,579.44   | 4,243,974.22   | 4,236,301.78   |
| Total Unrestricted<br>Funds .....                                                                                                                                                                         | \$17,361.15 | \$5,630,003.82 | \$5,647,364.97 | \$5,547,128.02 |
| <i>Semi-Restricted Funds:</i>                                                                                                                                                                             |             |                |                |                |
| Wood Memorial:                                                                                                                                                                                            |             |                |                |                |
| Personalty.....                                                                                                                                                                                           | \$ 841.44   | \$ 108,816.40  | \$ 109,657.84  | \$ 109,657.84  |
| Real Estate.....                                                                                                                                                                                          | 27.32       | 547,936.00     | 547,963.32     | 502,633.22     |
| For the construction of a<br>building adequate to the<br>needs of the Society, any<br>surplus remaining to be<br>applied to such useful<br>purpose as counsel and<br>officers of Society may<br>determine |             |                |                |                |
| Total Semi-<br>Restricted Funds..                                                                                                                                                                         | \$ 868.76   | \$ 656,752.40  | \$ 657,621.16  | \$ 612,291.06  |
| <i>Restricted Funds:</i>                                                                                                                                                                                  |             |                |                |                |
| Library Funds:                                                                                                                                                                                            |             |                |                |                |
| Carnegie Library                                                                                                                                                                                          |             |                |                |                |
| For maintenance of Li-<br>brary.....                                                                                                                                                                      | \$ 4,629.44 | \$ 95,530.63   | \$ 100,160.07  | \$ 100,260.07  |
| Henry Phillips, Jr.<br>(See Associated Fund for<br>additional \$94,510.56<br>in Fund).....                                                                                                                |             | 491.53*        | 491.53         | 491.53         |
| Special Funds:                                                                                                                                                                                            |             |                |                |                |
| Judson Daland                                                                                                                                                                                             |             |                |                |                |
| For research in Clinical<br>Medicine.....                                                                                                                                                                 | 2,584.67    | 223,546.35     | 226,131.02     | 226,532.11     |
| Henry M. Phillips Prize<br>Essay<br>Prize for essay on Science<br>and Philosophy of Juris-<br>prudence.....                                                                                               | 216.90      | 12,400.00      | 12,616.90      | 12,619.62      |
| Total Restricted<br>Funds.....                                                                                                                                                                            | \$ 7,431.01 | \$ 331,968.51  | \$ 339,399.52  | \$ 339,903.33  |

\* Held by Pennsylvania Co., etc., as agent.

## REPORT OF COMMITTEE ON FINANCE

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*Associated Fund:*

|                                                                                                                                                                                                                       |             |                |                |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|----------------|----------------|
| Thomas Balch International Law                                                                                                                                                                                        |             |                |                |                |
| For books relating to the Law of Nations.....                                                                                                                                                                         | \$          | 4,779.57       | \$             | 4,697.27       |
| Martin Boyé                                                                                                                                                                                                           |             |                |                |                |
| For books—Chemistry and Geology.....                                                                                                                                                                                  |             | 3,488.42       |                | 3,483.11       |
| Charles Francis Brush Endowment                                                                                                                                                                                       |             |                |                |                |
| For general purposes... ..                                                                                                                                                                                            |             | 11,653.73      |                | 11,682.61      |
| Auguste Carlier                                                                                                                                                                                                       |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 14,500.74      |                | 14,478.64      |
| Benjamin Franklin                                                                                                                                                                                                     |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 10,286.60      |                | 10,270.91      |
| Thomas Jefferson                                                                                                                                                                                                      |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 3,873.75       |                | 3,867.86       |
| John F. Lewis Prize                                                                                                                                                                                                   |             |                |                |                |
| For an award to the American Citizen who shall announce at any general or special meeting of the Society and publish among its papers some truth which the Council of the Society shall deem worthy of the award..... |             | 10,530.56      |                | 10,514.50      |
| Magellanic Fund                                                                                                                                                                                                       |             |                |                |                |
| Prize for discovery or invention and for books in field of Navigation, Astronomy or National Philosophy.....                                                                                                          |             | 5,772.12       |                | 5,763.33       |
| François André Michaux                                                                                                                                                                                                |             |                |                |                |
| For books on Forestry... ..                                                                                                                                                                                           |             | 54,934.36      |                | 54,850.63      |
| Joseph Parker Norris                                                                                                                                                                                                  |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 4,821.51       |                | 4,814.16       |
| Henry Phillips, Jr.                                                                                                                                                                                                   |             |                |                |                |
| For books on Archaeology and Philology.....                                                                                                                                                                           |             | 94,510.56      |                | 91,166.51      |
| (See Restricted Funds for additional \$491.53 in Fund)                                                                                                                                                                |             |                |                |                |
| Robert Proud                                                                                                                                                                                                          |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 5,906.48       |                | 5,897.48       |
| Henry Seybert                                                                                                                                                                                                         |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 3,959.08       |                | 3,953.05       |
| William Tilghman                                                                                                                                                                                                      |             |                |                |                |
| For books.....                                                                                                                                                                                                        |             | 2,106.58       |                | 2,103.36       |
| Total Associated Fund.....                                                                                                                                                                                            | \$          | 1,753.79       | \$             | 229,370.27     |
|                                                                                                                                                                                                                       | \$          | 231,124.06     | \$             | 227,543.42     |
| Total All Funds....                                                                                                                                                                                                   | \$27,414.71 | \$6,848,095.00 | \$6,875,509.71 | \$6,726,865.83 |



## Brought forward—Total All

|            |             |                |                |                |
|------------|-------------|----------------|----------------|----------------|
| Funds..... | \$27,414.71 | \$6,848,095.00 | \$6,875,509.71 | \$6,726,865.83 |
|------------|-------------|----------------|----------------|----------------|

## Invested in:

|                                                   |                |                |
|---------------------------------------------------|----------------|----------------|
| U. S. Government Obligations.....                 | \$1,854,122.34 | \$1,975,734.84 |
| Foreign Government Bonds.....                     | 100,000.00     | 100,000.00     |
| State, County and Municipal Bonds.....            | 607,038.75     | 610,945.00     |
| Railway, Utility, Industrial and Other Bonds..... | 1,357,317.25   | 1,346,218.33   |
| Stocks.....                                       | 2,293,156.72   | 1,977,545.33   |
| Mortgages and Mortgage Participations.....        | 57,692.28      | 77,344.47      |
| Real Estate and Real Estate Participations.....   | 573,551.76     | 565,351.76     |
| Perpetual Fire Insurance Policies.....            | 5,215.90       | 5,621.20       |
| (including prepaid value—Fine Arts Policy)        |                |                |

|  |                |                |
|--|----------------|----------------|
|  | \$6,848,095.00 | \$6,658,760.93 |
|--|----------------|----------------|

|                      |           |           |
|----------------------|-----------|-----------|
| Uninvested Cash..... | 27,414.71 | 68,104.90 |
|----------------------|-----------|-----------|

|  |                |                |
|--|----------------|----------------|
|  | \$6,875,509.71 | \$6,726,865.83 |
|--|----------------|----------------|

## SUMMARY OF INCREASE IN INVESTMENTS

|                                       |                |
|---------------------------------------|----------------|
| Balance at Book Value 12-31-1940..... | \$6,658,760.93 |
|---------------------------------------|----------------|

## Add:

|                                                                 |                       |
|-----------------------------------------------------------------|-----------------------|
| Stock Dividend of 62 shares of American Cyanamid Co. 5% Cum.    |                       |
| Preference received on 500 shares American Cyanamid Co. class B |                       |
| Common.....                                                     | 697.50                |
| Investments Purchased at cost.....                              | 1,018,135.91          |
|                                                                 | <u>\$7,677,594.34</u> |

## Deduct:

|                                                      |                   |
|------------------------------------------------------|-------------------|
| Investments sold (\$338,225.16) at book value.....   | \$322,750.59      |
| Investments transferred to worthless securities..... | 4.00              |
| Premiums charged off on Bonds purchased.....         | 4,344.75          |
| Cost of Exchange—City of Philadelphia Bonds—other    |                   |
| than Associated Fund.....                            | 2,400.00          |
|                                                      | <u>829,499.34</u> |

|                                       |                |
|---------------------------------------|----------------|
| Balance at Book Value 12-31-1941..... | \$6,848,095.00 |
|---------------------------------------|----------------|

## SCHEDULE VIII

## BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

## CASH RECEIPTS AND DISBURSEMENTS

*Year ended December 31, 1941**Principal Account*

Balance, January 1, 1941..... \$ 5,728.71

## Receipts:

|                                       |                  |             |
|---------------------------------------|------------------|-------------|
| Investment in Bonds sold .....        | \$60,553.06      |             |
| Mortgages paid in part.....           | 3,419.00         |             |
| Real Estate sold, etc. ....           | 1,261.45         |             |
| Transferred from Income Account ..... | 19,579.42        |             |
|                                       | <u>84,812.93</u> |             |
|                                       |                  | \$90,541.64 |

## Disbursements:

|                                                                                                                                                                     |                  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--|
| Invested in Bonds.....                                                                                                                                              | \$75,000.00      |  |
| Transferred to Fidelity-Philadelphia Trust Company,<br>Treasurer (General Fund) in reimbursement for al-<br>terations and furnishing of Society's building, etc.... | 3,791.30         |  |
| Costs, Real Estate Sales, etc. ....                                                                                                                                 | 87.17            |  |
| Forwarding Charges on Investments.....                                                                                                                              | 7.24             |  |
|                                                                                                                                                                     | <u>78,885.71</u> |  |

Balance, December 31, 1941..... \$11,655.93*Income Account*

## Receipts:

|                                                                  |                    |  |
|------------------------------------------------------------------|--------------------|--|
| Income from Investments.....                                     | \$23,746.53        |  |
| Estate of Henry G. Bryant, Deceased—on account of<br>income..... | 23.25              |  |
|                                                                  | <u>\$23,774.78</u> |  |

## Disbursements:

|                                          |                    |  |
|------------------------------------------|--------------------|--|
| Real Estate Expenses.....                | \$ 3,200.11        |  |
| Commission—Girard Trust Company.....     | 897.37             |  |
| Notary and Appraisal Fees.....           | 1.20               |  |
| Transferred to Principal Account.....    | 19,579.42          |  |
| Accrued Interest on Bonds Purchased..... | 96.68              |  |
|                                          | <u>\$23,774.78</u> |  |

## SCHEDULE IX

## BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

## SUMMARY OF ASSETS

|                         | Balance<br>1-1-1941 | Additions           | Deductions          | Balance<br>12-31-1941 |
|-------------------------|---------------------|---------------------|---------------------|-----------------------|
| Pledges Receivable..... | \$ 11,229.17        | —                   | —                   | \$ 11,229.17          |
| Investments:            |                     |                     |                     |                       |
| Bonds (Par Value) . . . | 290,000.00          | \$ 75,000.00        | \$ 56,000.00        | 309,000.00            |
| Stocks (At Cost).....   | 49,644.13           | —                   | —                   | 49,644.13             |
| Mortgages               |                     |                     |                     |                       |
| (Participations) . . .  | 152,000.93          | —                   | 3,419.00            | —                     |
|                         |                     |                     | 10,000.00*          | 138,581.93            |
| Real Estate             |                     |                     |                     |                       |
| (Participations)....    | 117,823.65          | 87.17               |                     |                       |
|                         |                     | 10,000.00*          | 1,261.45            | 126,649.37            |
| Cash—Principal.....     | 5,728.71            | 84,812.93           | 78,885.71           | 11,655.93             |
| Cash—Income.....        | —                   | 23,774.78           | 23,774.78           | —                     |
|                         | <u>\$626,426.59</u> | <u>\$193,674.88</u> | <u>\$173,340.94</u> | <u>\$646,760.53†</u>  |

## SUMMARY OF INCREASE IN FUND

Year ended December 31, 1941

|                                                                                                                                                                |                  |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| Income from Investments.....                                                                                                                                   | \$23,746.53      |                     |
| Less:                                                                                                                                                          |                  |                     |
| Accrued Interest on Bonds Purchased....                                                                                                                        | 96.68            |                     |
|                                                                                                                                                                | <u>23,649.85</u> |                     |
| Gain on Sale of Bonds.....                                                                                                                                     |                  | 4,553.06            |
| Estate of Henry G. Bryant, Deceased—on account of<br>Income.....                                                                                               |                  | 28.25               |
|                                                                                                                                                                |                  | <u>\$ 28,231.16</u> |
| Less:                                                                                                                                                          |                  |                     |
| Real Estate Expenses.....                                                                                                                                      | \$ 3,200.11      |                     |
| Transferred to Fidelity-Philadelphia Trust Company,<br>Treasurer (General Fund) in reimbursement for<br>alterations and furnishing of Society's building, etc. | 3,791.30         |                     |
| Commission—Girard Trust Company.....                                                                                                                           | 897.37           |                     |
| Forwarding Charges on Investments.....                                                                                                                         | 7.24             |                     |
| Notary and Appraisal Fees.....                                                                                                                                 | 1.20             |                     |
|                                                                                                                                                                | <u>7,897.22</u>  |                     |
| Increase in Fund.....                                                                                                                                          |                  | \$ 20,333.94        |
| Balance, January 1, 1941.....                                                                                                                                  |                  | 626,426.59          |
| Balance, December 31, 1941.....                                                                                                                                |                  | <u>\$646,760.53</u> |

\* Face value of mortgage foreclosed and real estate acquired.

† Includes bonds at Par Value. Total Fund including bonds at cost is \$654,884.28.

## VI

### REPORTS OF SPECIAL COMMITTEES

#### 1. REPORT OF THE COMMITTEE ON EDUCATION AND PARTICIPATION IN SCIENCE

By W. STEPHEN THOMAS, *Executive Secretary*

##### I. COMMITTEE

As has been stated in the YEAR BOOK for 1940, the function of the Committee on Education and Participation in Science has been the study of adult education in science with special reference to amateur science in the Philadelphia area. The Committee's program since June 1, 1939, has been made possible by a series of three grants from the Carnegie Corporation of New York, representing, over two and a half years, a total sum of \$34,740.29, which amount was augmented by \$2,000 appropriated by the American Philosophical Society to the Committee on Research for the amateur science activities in June 1941. On December 31, 1941, there was still unexpended \$9,730.17. As the goals set by the Committee on Organization have been virtually achieved, and as the Executive Secretary will be obliged to resign to enter active war service, it has been decided to terminate the work of the Committee for the time being. For these reasons the ensuing statements must constitute a concluding report.

Since its inception, the Committee's program has been divided into two parts. First, in the early months of its existence its efforts were aimed, as an exploratory venture, to determine the public's interest in science, as well as to investigate the status of those seriously minded laymen who not only participate in various types of scientific activities, but on occasion actually contribute to the advancement of science. Second, the Committee was authorized to experiment with ways and means of stimulating advanced amateur scientists in programs which would enrich their knowledge and experience, and, whenever possible, produce results of use in scientific research.

The members of the American Philosophical Society, constituting the Committee on Organization, which has determined the policy of operation, were, Edwin G. Conklin, *Chairman*, Anton J. Carlson, Karl K. Darrow, Luther P. Eisenhart, C. E. Kenneth Mees, Oscar Riddle, Harlow Shapley, George G. Simpson, W. F. G. Swann, Edward L. Thorndike, Harold C. Urey, and Roland S. Morris, *ex-officio*. During 1941 the Committee on Organization held dinner-meetings on February 13 and November 20. On April 25, Dr. Conklin as Chairman made a progress report on behalf of the Committee to the membership of the American Philosophical Society in Executive Session.

As previously explained, the Committee has operated through an Executive Staff, consisting of four part-time consultants, Roger Conant in Zoology, John M. Fogg, Jr., in Botany, Serge A. Korff in Physics and Astronomy, and Edward E. Wildman in General Science with Roland S. Morris as Chairman and W. Stephen Thomas as Executive Secretary.

## II. ACTIVITIES OF THE EXECUTIVE STAFF

Commissioned to stimulate amateur science in and around Philadelphia, the duties of the Executive Staff of the Committee have comprised work in planning, administration, education, research, editing and publicity. Not only was it an aim to benefit the public through education in science and to promote original knowledge but the program functioned as a test operation which, it was hoped, would serve as an example for similar programs in other regions of the United States. In the following report the Staff's activities are divided into three functions, as follows: (A) research projects, (B) general stimulation, (C) assistance to other agencies.

### *A. Research Projects for Amateur Scientists*

As has been stated in preceding reports, a major effort of the Committee has been the research programs in botany, climatology, physics and zoology—which have enlisted the aid of considerable numbers of laymen in observing and fact-finding. During 1941 these projects were greatly expanded and more than five hundred different persons worked on various phases of the work during the year.

*Botany*

Benefitted by the pioneer activities of the previous season, Dr. John M. Fogg, Jr., in 1941, improved and enlarged the program for studying the blooming dates of plants which had special appeal for amateur gardeners and nature lovers. He prepared, in addition to the lists of wild flowers, extensive charts for recording the dates of 151 species of cultivated plants. From October until March 315 persons reported as working on this project in widely scattered locations in and around Philadelphia. To 39 of the volunteers who produced the best results the Committee awarded a certificate of merit. From the hundreds of individual records which the co-operators obtained it was possible to prepare a list of local wild flowers with comparative blooming dates for 1940 and 1941. These yielded many facts of scientific interest.

In order to stimulate interest in the botanical studies, as well as to demonstrate the proper method of obtaining data, three indoor meetings and three field excursions were conducted during the flowering season in April and May by Dr. Fogg. There was a total attendance of 216 persons on these occasions. Another means of attracting the attention of persons who might become project workers was a series of five exhibits of charts, photographs and other materials. The most notable of these was a display at the Philadelphia Flower Show at Convention Hall from March 24 to 29, which was made possible by the courtesy of the management.

*Climatological Study of the Delaware Valley Through Tree Ring Records*

The appeal for information on the location and condition of trees estimated to be over 250 years old as well as of buildings containing ancient timbers yielded fruitful results during this second year. As emphasis was placed on the making of paper strip "rubblings" of the cross-sections of logs and beams, revealing the patterns of the trees' annual growth rings, many interesting records were obtained. During 1941, under the guidance of Dr. Edward E. Wildman, who directed the project, over 40 persons showed active interest in this work, of which 21 were awarded certificates of merit for special achievement. Space for meetings and the storage of specimens of tree cross-sections was generously donated by the Academy of Natural Sciences. As a result of information already gathered, progress

can be reported on the projected chart of climatological data of the Delaware Valley for the last 250 years. Much information has also been accumulated on the increase of girth and growth conditions of ancient trees still living in the neighborhood of Philadelphia.

Two numbers of "The Tree Ring Log," a mimeographed bulletin for cooperators, were issued during the year and Dr. Wildman gave a series of demonstrations and talks before 15 different groups at the Philadelphia Flower Show, the Progressive Education Association meeting and other educational gatherings, reaching more than 2,000 persons in this way. Although, as previously stated, the activities of the Committee as a whole will be terminated in 1942, Dr. Wildman has generously planned to continue his direction of the work for the most interested cooperators.

### *Physics-Ionosphere Research Project*

The ionosphere-radio research program of the Committee, headed by Dr. Serge A. Korff, bore results continuously throughout 1941. It has been stated before that this project utilized the volunteer services of amateur radio operators who charted receptions, fade-outs and skip-distance occurrences encountered in the course of regular radio communication. Previous experience showed that the most satisfactory results were obtained by the systematic guarding of assigned bands on the various frequencies. Thirty-seven amateurs, consistently recording signals on bands from 1.8 megacycles to 11.2 megacycles, worked by mutual agreement at one hour per week each evening during most of the year. Seventeen of these co-operators received certificates for special efforts.

Data compiled by Mr. Winston Sheppard, one of the volunteers, were utilized at once by the Department of Terrestrial Magnetism of the Carnegie Institution in Washington, D. C., the Director of which Department, Dr. John A. Fleming, wrote to Dr. Korff concerning the records of the Philadelphia amateurs: "We are finding this material to be increasingly useful to our studies of radio wave propagation in connection with our ionosphere investigations."

### *Zoology Project-Study of Animal Life Histories*

From spring to fall of 1941, 120 persons in and around Philadelphia took part in the various phases of the project under Roger Conant, which was aimed to determine the life histories of frogs,

salamanders, turtles and insects. The various tasks were carried on by individuals working by themselves or in groups. Group participation, which had many advantages, was particularly profitable in the life history studies of frogs in the Tinicum marshes of South Philadelphia. The zealous leadership of Ralph B. Lutz has made possible successful work in that area. Assisted by other volunteers, he led over thirty field excursions not only for adults who were participating in the scientific work of capturing, weighing and tagging frogs, but also for school children of the vicinity whose teachers sought guidance.

Altogether 32 persons did outstanding work for the Committee and were presented with certificates for their contributions. Robert Hudson, in the course of an intensive study of the snakes of Philadelphia parks, gathered some new scientific data. Eight persons carried on similar investigations with turtles, marking hundreds of specimens. Four indoor meetings for zoology collaborators were held at the American Philosophical Society at some of which outside speakers addressed the group. Finally, an indication that these activities have proved worthwhile to those concerned is the fact that 30 of the most active volunteers have formed their own organization which will continue to stimulate amateur participation in zoological investigations.

### *B. Stimulating Activity in Science*

Publications constituted an important channel for appealing to public interest in amateur science. The Committee found that its pamphlet-directory, "The Layman Scientist in Philadelphia," served to arouse attention. In 1941 copies were distributed widely not only in Philadelphia but to persons and institutions in 107 cities, located in 21 different states. From October to June 1,000 interested persons received without cost to them "Activities in Science," a four page leaflet. Also in the course of the year the office of the Executive Secretary issued in mimeographed form 20 different types of instructional material. These, together with letters, questionnaires and notices, represented a total of 25,000 pieces of mimeographed matter which were prepared and distributed.

### *Talks and Consultation Service*

The Executive Staff reached over 2,500 interested members of communities in and around Philadelphia by means of informal talks



and lectures. In the course of 69 talks by the Staff, 41 of which were by the Executive Secretary, groups were visited which included scientific clubs, garden clubs, educational bodies and women's and young people's organizations. Also, serving as an informal center of information and clearing-house, the Executive Office scheduled personal conferences and gave facts over the telephone to over 100 persons. Correspondence, represented by 1,500 letters written during the year, involved considerable time and effort.

### *Philadelphia Council of Amateur Scientists*

The most concrete evidence of the Committee's efforts to bring about a coordination of amateur scientific interest is to be seen in the Philadelphia Council of Amateur Scientists. Organized in May, 1940, this federation represents 22 different clubs and societies, each of which annually elects a delegate and alternate. As stated in its Constitution, "The purpose of the Council shall be to disseminate knowledge of and promote interest in the pure and applied sciences among the general public, with special reference to accomplish these aims through the cooperation of the various member clubs." In addition to six meetings of the Executive Council, there were three meetings of the general membership held at the American Philosophical Society in 1941. Activities of the Council have included the preparation of a speakers' file for the member groups, field trips, and the publication of a quarterly *Journal*, which contains, besides news of the organizations, original articles by individual members. As the Council is the first purely amateur affiliation of adult scientific groups, it is hoped that it will continue as a permanent body and perpetuate the initial efforts of the Committee.

### *C. Assistance to Other Agencies*

During 1941 the Executive Secretary, aside from his official duties, served as Vice-Chairman and a member of the Executive Committee of the Adult Education Council of Philadelphia. He also retained membership in the Museums Council of Philadelphia and during the year was elected to serve on educational committees of the Young Men's Christian Association in Philadelphia and the Philadelphia Council of the Boy Scouts of America. As one of a small group he took part in the founding of The Junto, a school of

adult education, which during its first term of existence from October to December 1941, had enrolled 5,600 individuals in 35 evening classes in institutes, libraries and museums throughout the city. Fifteen per cent of the registrants were in such popular scientific courses as archaeology, astronomy, chemistry and nature study.

In December 1941, the Committee, at the request of the Office of Civilian Defense in Washington, was active in the preparation of a plan for the utilization of skilled amateur scientists in national defense. It was proposed that in various densely populated communities throughout the country local rosters or lists of skilled amateurs be prepared so that their part-time or full-time efforts could be used in technical government agencies, in defense industries, or in civilian protection.

### III. CONCLUSION

After two years and seven months of continuous activity in the relatively little developed field of amateur science and adult education in science, the Committee on Education and Participation in Science of the American Philosophical Society has achieved the following results:

1. It has shown that in urban communities, of which Philadelphia is an example, there is a large general public with some interest in the sciences. There is also a smaller and more select group of laymen who actively pursue scientific interests as hobbies. Many of the latter form their own organizations for education, research and mutual benefit.

2. It has revealed that it is feasible under certain circumstances and with guidance of professionals for amateurs to assist as volunteers in making observations and collecting data which are useful in furthering original research.

3. It has demonstrated that, although there exist in most large, urban communities such institutions as universities, libraries, museums and other such centers for diffusing scientific information and advancing knowledge, there is need for greater coordination and acceleration of the activities of these agencies.

4. It has pointed out, through demonstrations, experiments and the publicizing of existing efforts, the worth and importance of amateur contribution to the sciences. It has also shown that greater cooperation should be established between the amateur and the professional.

5. It has left permanent results of its exploratory activities in a series of informational publications and in a permanent affiliation in Philadelphia of amateur clubs and societies as well as several informal groups of laymen. Lastly, the Executive Secretary of the Committee has prepared a two hundred page manuscript report on the problem of amateur science which has been accepted for publication by a leading publisher.

6. More than five hundred persons have been actively engaged in carrying out original work on scientific problems and more than one hundred of these did work of such distinction as to earn certificates of merit. Such work must have helped to make many of these "scientifically minded."

## 2. REPORT<sup>1</sup> OF THE SPECIAL COMMITTEE ON THE FUTURE POLICY OF THE LIBRARY

The Special Committee to study the relations of the Library of the American Philosophical Society to other libraries in Philadelphia and also the future policy of the Library administration has approached the subject with an open mind, even to the extent of considering the possibility of dispersing the collections among other libraries in the Philadelphia area, or depositing parts of them on loan in other institutions.

A collection of books has been an integral part of the American Philosophical Society from its very beginning—even in the days of the Junto. As soon as the joint societies organized, they formed a library. Through the devotion of the Society's officers and members, during its formative years and notably again when Philadelphia was the seat of the federal government, the Library was the recipient of many gifts and bequests. Another occasion came when the revival of the past received fresh impetus after the War of 1812 and the foundations of the Society's collections were built upon by Thomas Jefferson, P(eter) S(tephen) Du Ponceau, the Vaughans, and later by Jared Sparks. Many others should be included, but those mentioned are sufficient to indicate the character and quality of the persons who made the Library of the Society a depository for printed works and manuscripts, some of which are now almost priceless.

It is necessary only to mention the great collection of the papers of Benjamin Franklin, the Lewis and Clark journals, and other records of early exploration of the West—they are known to everyone. It is not so generally appreciated that the archives of the Society present an unusual record, for over a hundred and fifty years, of intellectual interests and activities in the United States. Among the acquisitions of early years were the transactions of the Royal Society and other learned bodies. In the course of a century and a half, the Library has, somewhat intermittently but on the whole consistently, maintained its general lines of development, and particularly its runs of periodicals and transactions of so-

<sup>1</sup> Presented at Executive Session of the Society, April 25, 1941.

cieties, until they form an extraordinary collection. They also present a serious problem.

The ownership of such treasures entails a responsibility for their preservation and care, and an obligation to make them available for use. The American Philosophical Society owes it to itself, to the community, to the United States, and to the world at large, to preserve its Library and to make its contents known. To the Special Committee, accordingly, the essential question was, not the maintenance of the Library, but how economically and productively it is managed.

The collections are at present housed in reasonably safe quarters. They are accessioned and catalogued, and are slowly but steadily being put into condition—that is, as to binding and repair. Steam heat is a detriment, especially because of its effect on old leather, but the conditions of the Library in general are superior to others in the Philadelphia area. The amount of manuscript material and of extremely rare books goes beyond the accommodations of the space in the vaults at the present time. In that respect conditions are not adequate, but otherwise the Library is reasonably well housed.

The library quarters are not unduly expensive considering all the facilities which are offered in connection with the space occupied. Total appropriations for the Library in 1940 amounted to \$38,270 including the income from special funds assigned to the Library to the amount of \$10,800, and the actual expenditures for the Library drawn from General Fund were only \$21,697. It would seem to the Special Committee that \$30,000 per year would not be an undue appropriation for the American Philosophical Society to make from its General Fund for the care and upkeep of such a collection.

The difficulty is, however, that the cost of the Library tends to increase rather than to diminish. The collections were moved into their present quarters in the Drexel Building in June 1934. The following year two additional rooms were rented, and in 1937 arrangements were made for 1,500 square feet of additional space. This situation apparently led to the appointment of the Special Committee.

If the recommendations of the Special Committee are adopted, the present accommodations should suffice for many years to come,

even with a larger number of readers. The Society, however, must face the contingency that an office building is always an uncertain habitation. The Committee, moreover, believes that a considerably increased use of the Library will result from making its contents known. The combination of these two factors may lead the administrative officers in the future to consider again the possibility of a separate building.

The Special Committee has noted with interest the early efforts of the American Philosophical Society to promote co-operation with other libraries in Philadelphia, and particularly with those whose collections are similar in character and in use, such as the Library Company, the Historical Society, the Academy of Natural Sciences, the Franklin Institute, and the University of Pennsylvania. To assist, if not to take the lead, in every co-operative effort of high degree is, in the opinion of the Committee, one of the most important means of promoting useful knowledge.

This Society was one of the early and generous contributors to the Union Library Catalogue of the Philadelphia Metropolitan Area. That catalogue was used by the Society before it was open to the public. The Union Catalogue brought sharply to attention a condition which had been known but not fully appreciated—namely, the amount of duplication with other libraries in the vicinity. The use of the Union Catalogue immediately reduced, to a considerable extent, duplication in new purchases, with one important exception; and that was in the matter of periodical publications. The American Philosophical Society staff was accordingly requested to prepare a complete list of the duplications, in serial acquisitions, of the American Philosophical Society Library with the other important libraries in Philadelphia named above.

In 1940 the American Philosophical Society Library's serial acquisitions numbered about 1,500 titles, of which nearly two-thirds were received in exchange, over one-tenth by gift, and only about one-fifth acquired by purchase. The list prepared by the staff reveals that, of these 1,500 titles, only 360 are not duplicated in some other library, and one-third of the total are duplicated in at least two libraries, and sometimes in three or four. Some of these continuations are of first-rate importance and should be maintained. The others dwindle rapidly in value, until they become a liability and not an asset.

The fact that so large a proportion of these serial acquisitions come by gift or exchange is beside the mark. Each volume costs over two dollars for binding and cataloguing, and then costs 13½ cents for shelf space annually for evermore. Multiply those figures by 1,500 and it is easy to see why the increasing library expenses are alarming. The American Philosophical Society could better afford to give away its own YEAR BOOK and other publications, without return, or to present to other libraries the greater part of what it receives in exchange, than to go to the expense of accessioning and shelving unwanted material.

Data compiled for a report on Philadelphia libraries offer comparisons that must not be pushed too far without taking all factors or elements into consideration, but they are illuminating. Out of thirty-one libraries included in the compilation, the American Philosophical Society was fourteenth in the number of volumes it possessed, fifteenth in the cost of its staff, ninth in the total annual costs, and third in the number of periodicals received.

At this point another factor enters in. The American Philosophical Society Library collections are not used by members of the Society to an extent that justifies the cost of upkeep. Consequently, what the American Philosophical Society does with its Library is mainly for the benefit of others. A few students come from a distance to examine particular items or collections, but the greater use is local, and the Library is inconveniently situated for local use. The larger service consists in lending volumes to neighboring societies and institutions, and of supplying photographic copies, mainly of manuscript items, at cost.

The American Philosophical Society has been well served by its successive Librarians and Library Committees. They and the staff are the only ones who have anything approaching an adequate knowledge of what the Library contains. Accordingly, the recommendations of the Special Committee take the form of authorizing and encouraging the Library Committee to take action under the conditions that have come to light.

There are certain collections, sets, and individual items that the American Philosophical Society would be most unwilling to have pass out of its own custody. Others have little intrinsic or association value, and as they are not used they are simply costly encumbrances. In considering the duplication with other organizations

and the possible disposal or retention of any material, the Special Committee hopes the criterion will be, not the monetary value, but the usefulness over a long period of time.

The first recommendation follows:

That the Library Committee be requested to reconsider carefully all of the Library's holdings, and particularly the whole list of serial publications, in the light of the list of duplications with other libraries in Philadelphia. In view of the fact that the American Philosophical Society Library is used mostly by non-members, for whom other libraries are more conveniently located, the Library Committee be urged to decrease the number of volumes on the shelves, and reduce drastically the number of continuations, especially those that are kept at the American Philosophical Society Library. To assist it in making such reductions the Library Committee be empowered to dispose of less important items and series and to place some more important ones on loan in other libraries, where their safekeeping may be assured and their use will be greater than in their present location.

The American Philosophical Society is not a collector of rarities. It is an active agency "for promoting useful knowledge." The Library, because of its character and the quality of its material, should continue to be primarily a research library for qualified students. It would doubtless be used by neighboring schools, colleges, and universities for graduate and even undergraduate work, if encouraged; but, in the opinion of the Special Committee, the province of the Library is not that of educating students, nor of helping them to obtain degrees. The American Philosophical Society is interested only to the extent that students use the material for the advancement of learning. Accordingly, the Committee presents a second recommendation:

That the Library Committee be urged, in selecting fields and subjects for cultivation, to insist even more rigidly than in the past upon choosing those capable of development to a point of superiority, so that the material when gathered may be used by advanced students in productive research.

The Library of the American Philosophical Society has the reputation of being peculiarly strong on the history of science. It is noteworthy in that line, but rather because of the rarity of sets and individual items than through the completeness of the collections on more than a very few aspects. The field is so vast that no institution can cover all of it. The Library should stand



ready, as it has in the past, to supplement the holdings of other libraries, so that there may be, in the Philadelphia area, as complete collections as can be gathered upon as many phases as possible of the history of science. The Library itself should make no attempt to cover the whole field. Moreover, it must be recognized and accepted that the American Philosophical Society's collections are little used for study of this subject. Since this Special Committee was established, not a few members of the Society have spoken of the fine reputation the Library bears in their communities. Upon investigation, this high repute proved almost invariably to be based upon the use of manuscripts, chiefly in the Franklin collection, but also of journals of travel and of rare printed material along similar lines. Only one instance was brought to attention of the use of the Library for the history of science.

The policy of the Library should not be determined by such haphazard testimony; but the impressions recorded are confirmed by the observations of the Library staff. Exact records of the material used by readers in the Library or requested from outside have not been kept long enough to warrant the drawing of conclusions, but they point in the same direction.

The Special Committee accordingly urges the members of the Society to think of their Library not so much as containing valuable and unused material relating to the history of science, but rather as possessing in the Society's archives and collections an extraordinary record of intellectual interests and activities in this country. The Library Committee should be encouraged to regard the scope of the Library as relating to intellectual development in the United States, especially as embodied in the activities of the American Philosophical Society itself and exemplified and illustrated by its members, who have always been leaders of thought in this country. The Library Committee apparently has long been building along these lines, and if it can be freed from the obligation to maintain a large number of series of unused periodicals, more rapid progress should be made.

Finally, the Special Committee reiterates that an obligation rests upon the Society to make known the contents of its Library, for the benefit of students, in other ways than by forcing them to come to the building to consult the card catalogue. The Library Committee should be encouraged to follow a consistent policy of gathering and publishing information regarding the collections.

The Special Committee also urges the administrative officers and committees in charge to give encouragement and precedence to publishing lists or catalogues of and articles relating to the holdings of the Society. If this policy is followed, it is believed that a marked increase in the study of these valuable collections would result and thereby advance the Society's purpose of promoting useful knowledge.

HARRY M. LYDENBERG,  
HARLOW SHAPLEY,  
ST. GEORGE L. SIOUSSAT,  
MAX FARRAND, *Chairman*

## VII

### AWARDS OF PRIZES

**MAGELLANIC FUND**, established in 1786 by the gift of 200 guineas by John Hyacinth de Magellan, of London, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws.

#### *Awards of the Magellanic Premium*

- December 1790. To FRANCIS HOPKINSON, Philadelphia, Penna. For the Invention of the Spring Block. "Description of a Spring Block Designed to Assist a Vessel in Sailing" (TRANS. Amer. Philos. Soc. 3, Art. 40, 1793).
- December 1792. To ROBERT PATTERSON, Philadelphia, Penna. For the Improvement of Electrical Rods, or Lightning Conductors, by Pointing them with Black-lead. "An Improvement on Metallic Conductors or Lightning-rods in a Letter to Dr. David Rittenhouse from Robert Patterson" (TRANS. Amer. Philos. Soc. 3, Art. 35, 1793).
- December 1792. To WILLIAM THORNTON, London, England. For "Cadmus" or a Philosophical Dissertation on the Elements of Written Language. "Cadmus, or a Treatise on the Elements of Written Language, illustrating, by a Philosophical Division of Speech, the power of each Character, thereby mutually fixing the Orthography and Orthoepy. With an Essay on the Mode of Teaching the Surd, or Deaf and Consequently Dumb to Speak" (TRANS. Amer. Philos. Soc. 3, Art. 33, 1793).
- December 1794. To NICOLAS COLLIN, Philadelphia, Penna. For a Paper on an Elevator (Nititor [sic] in ardua virtus). "Description of a Speedy Elevator by the Inventor" (TRANS. Amer. Philos. Soc. 4, Art. 75, 1799).
- November 1804. To CAPTAIN WILLIAM MUGFORD, Salem, Mass. For the Invention of a Temporary Rudder. "An account and description of a Temporary Rudder Invented by Capt. William Mugford of Salem, Mass." (TRANS. Amer. Philos. Soc. 6, Art. 34, 1809).

- December 1804. To DR. BEN SMITH BARTON, Philadelphia, Penna. For a Paper on a "Number of the Pernicious Insects of the United States."
- October 1807. To JOHN GARNETT, New Brunswick, N. J. For a Paper on "A New Simple Nautical Chart." "Description and use of a new and simple Nautical Chart, for working the different problems in Navigation" (TRANS. Amer. Philos. Soc. 6. Art. 49, 1809).
- April 1809. To JAMES HUMPHRIES, JR., Philadelphia, Penna. For a Model and Description of Steering Apparatus.
- April 1820. To JOSHUA CHAPMAN, Bristol, Penna. For an Improvement in the Manufacture of Canvas.
- March 1823. To DR. JAS. EWING, Philadelphia, Penna. For the invention of the "Improved Hydrant."
- May 1825. To C. C. BRODIE. For an invention to repair the side of ships, under the surface of the water.
- March 1836. To JAMES P. ESPY, Philadelphia, Penna. Author of the paper signed "Investigator."
- December 1864. To PLINY EARLE CHASE, Philadelphia, Penna. For a paper on "The discovery of Certain new relations between the solar- and lunar-diurnal variations of magnetic force and of barometric pressure" (PROC. Amer. Philos. Soc. 9: 487-495).
- December 1887. To LEWIS M. HAUPT, Philadelphia, Penna. For a paper on "The Physical Phenomena of Harbor Entrances. Their Causes and Remedies. Defects of Present Methods of Improvement" (PROC. Amer. Philos. Soc. 25: 19-41).
- April 1922. To PAUL R. HEYL AND LYMAN J. BRIGGS, U. S. Bureau of Standards, Washington, D. C. For the invention of the Earth Inductor Compass. "The Earth Inductor Compass" (PROC. Amer. Philos. Soc. 61: 15-32).

PHILLIPS PRIZE ESSAY FUND, established in 1888 by the gift of \$5,000 by Miss Emily Phillips, of Philadelphia, in memory of her brother, Henry M. Phillips. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

*Awards of the Henry M. Phillips Prize Essay*

- May 1895. To GEORGE H. SMITH, Esq., Los Angeles, Calif. \$500. "The Theory of State" (PROC. Amer. Philos. Soc. 34: 181-334).

- June 1900. To W. H. HASTINGS, Esq., Wilber, Neb. \$2,000. "The Development of Law as Illustrated by the Decisions Relating to the Police Power of the State" (Proc. Amer. Philos. Soc. 39: 359-554).
- April 1912. To CHARLES H. BURR, Esq., Philadelphia, Penna. \$2,000. "The Treaty-Making Power of the United States and the Methods of its Enforcement as Affecting the Police Powers of the States" (Proc. Amer. Philos. Soc. 51: 271-422).
- April 1921. To QUINCY WRIGHT, Esq., Minneapolis, Minn. \$2,000. "The Relative Rights, Duties and Responsibilities of the President, of the Senate and the House, and of the Judiciary in Theory and Practice" (Proc. Amer. Philos. Soc. 60: 99-455).
- October 1935. To LON L. FULLER, Dean of the Law School, Duke University, Durham, N. C. \$1,500 and Diploma. "American Legal Realism" (Proc. Amer. Philos. Soc. 76: 191-235).

LEWIS FUND, established in 1935 by the gift of Mrs. John F. Lewis, of Philadelphia, of \$10,000 in memory of her late husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award.

*Awards of the John F. Lewis Prize*

- April 1937. To RALPH E. CLELAND, Goucher College, Baltimore, Md. \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Cyto-taxonomic Studies on Certain Oenotheras from California" (Read April 19, 1934,—Proc. Amer. Philos. Soc. 75: 339-429). "A Cyto-genetic and Taxonomic Attack upon the Phylogeny and Systematics of Oenothera (Evening Primrose) with Special Reference to the Sub-genus Onagra" (Read April 18, 1935,—Proc. Amer. Philos. Soc. 77: 477-544).
- April 1938. To ARTHUR J. DEMPSTER, University of Chicago, Chicago, Ill. \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "New Methods in Mass Spectroscopy" (Read in part April 20, 1935,—Proc. Amer. Philos. Soc. 75: 755-767). "Further Experiments on the Mass Analysis of the Chemical Elements" (Read April 25, 1936,—Proc. Amer. Philos. Soc. 76: 491-496).
- April 1939. To HENRY NORRIS RUSSELL, Princeton University Observatory, Princeton, N. J. \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Stellar Energy" (Read February 17, 1939,—Proc. Amer. Philos. Soc. 81: 295-307).

- April 1940. To EARLE RADCLIFFE CALEY, Princeton University, Princeton, N. J. \$300 and Diploma, for presentation to the Society and publishing in its MEMOIRS: "The Composition of Ancient Greek Bronze Coins" (Read November 27, 1937,—MEM. Amer. Philos. Soc. 11: 1-203).
- April 1941. To GEORGE HOWARD PARKER, Professor Emeritus of Zoology, Harvard University, Cambridge, Mass. \$300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Integumentary Color Changes of Elasmobranch Fishes especially of Mustelus" (Read November 26, 1936.—Proc. Amer. Philos. Soc. 77: 223-247). "Melanophore Responses and Blood Supply (Vasomotor Changes)" (Read November 27, 1937,—Proc. Amer. Philos. Soc. 78: 513-527). "On the Neurohumors of the Color Changes in Catfishes and on Fats and Oils as Protective Agents for such Substances" (Read April 18, 1940,—Proc. Amer. Philos. Soc. 83: 379-408).

## VIII

### GENERAL MEETING LECTURES

#### THE R. A. F. PENROSE, JR., LECTURES

1934. Edwin G. Conklin, "A Generation's Progress in the Study of Evolution"
1935. W. F. G. Swann, "Is the Universe Running Down?"
1936. Dixon Ryan Fox, "The American Tradition in a New Day"
1937. Irving Langmuir, "The Surfaces of Solids and Liquids"
1938. S. A. Mitchell, "With an Astronomer on an Eclipse Expedition"
1939. Eduard Beneš,\* "Politics as Art and Science"
1940. Archibald MacLeish, "Writers and Scholars"
1941. Edward C. Tolman, "Motivation, Learning and Adjustment"

#### SPECIAL LECTURES

- November 1936. D'Arcy W. Thompson, "Astronomy in the Classics"
- February 1937. Frederick P. Keppel, "The Responsibility of Endowments in the Promotion of Knowledge"
- November 1937. William Lyon Phelps,\* "Truth and Poetry"
- February 1938. Dumas Malone, "The Scholar and the Public"
- Donald P. Bean, "The Riddle of Research"
- November 1938. Alfred J. Lotka, "Contacts of Population Study with Related Branches of Science"
- February 1939. Henry Norris Russell, "Stellar Energy and the Evolution of Atoms"
- November 1939. Carlton J. H. Hayes, "The Novelty of Totalitarianism in the History of Western Civilization"
- February 1940. Laurence M. Gould, "Glaciers of the Antarctic"
- April 1940. Dayton C. Miller, "The Pipes of Pan, Old and New"

\* Franklin Medal presented.

- November 1940. Edward S. Corwin,\* "Some Aspects of the Presidency"
- February 1941. John A. Fleming, "Geomagnetism: World-Wide and Cosmic Aspects with Especial Reference to Early Research in America"
- April 1941. Hugh S. Taylor,\* "Large Molecules Through Atomic Spectacles"
- November 1941. Vilhjalmur Stefansson, "Military Aspects of the Arctic"



## IX

### REPRESENTATION AT CELEBRATIONS OF SOCIETIES, INSTITUTIONS, ETC.

- January 17. Celebration of the birthday of Benjamin Franklin by the Poor Richard Club of Philadelphia and the Franklin Institute of Pennsylvania. W. Stephen Thomas.
- April 4-5. Forty-fifth Annual Meeting of the American Academy of Political and Social Sciences, Philadelphia. William E. Lingelbach, Emory R. Johnson, Solomon S. Huebner.
- April 29-May 5. Celebration of the Seventy-fifth Anniversary of the Opening of the Fisk School at Fisk University, Nashville, Tennessee. W. F. G. Swann.
- June 20. Academic Festival and Convocation Commemorating the Fiftieth Anniversary of the Founding of Stanford University, and Dedicatory Exercises of the Hoover Library on War, Revolution, and Peace. Robert A. Millikan.
- September 8-12. Second Conference on Science, Philosophy and Religion, Columbia University. William F. Albright.
- September 15-17. Centenary Celebration of the Founding of Fordham University. Hugh S. Taylor.
- September 27-29. Celebration of the Fiftieth Anniversary of the Founding of the University of Chicago. Roger Adams.
- October 9-11. Celebration of the One Hundred and Seventy-fifth Anniversary of the Founding of Rutgers University. Edwin G. Conklin, Edward S. Corwin.
- October 16-18. Celebration of the One Hundredth Anniversary of the Granting of the Royal Charter by Her Majesty Queen Victoria to Queen's University, Kingston, Ontario. S. A. Mitchell.
- December 4. Inauguration of Robert Livingston Johnson as President of Temple University, Philadelphia. Edwin G. Conklin.
- American Documentation Institute. Jacob R. Schramm.
- Emergency Committee in Aid of Displaced Foreign Scholars. Harold C. Urey.
- American Council of Learned Societies, Washington, D. C. Edward Capps, 1937-41; 1941-45. William E. Lingelbach, 1938-42.
- National Research Council, Division of Foreign Relations, Washington, D. C. Leo S. Rowe, 1940-43.

# X

## LIST OF MEMBERS

### MEMBERS RESIDING WITHIN THE UNITED STATES

|                                                                                                                                                                   | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Abbot, Charles Greeley, M.Sc., D.Sc., LL.D.<br>Astrophysicist, Secretary, Smithsonian Institution,<br>Washington, D. C.                                           | 1914                |
| Adams, Edwin Plimpton, M.S., Ph.D., Sc.D.<br>Professor of Physics, Princeton University,<br>Princeton, N. J.                                                      | 1915                |
| Adams, James Truslow, A.M., LL.D., Litt.D., L.H.D.<br>Author, American Historian.<br>Sheffield House, Southport, Conn.                                            | 1938                |
| Adams, Joseph Quincy, Ph.D., Litt.D.<br>Director, Folger Shakespeare Library.<br>2915 Foxhall Road, N.W., Washington, D.C.                                        | 1940                |
| Adams, Roger, A.B., A.M., Ph.D., Sc.D.<br>Head of the Chemistry Department, University of Illinois.<br>603 Michigan Avenue, Urbana, Ill.                          | 1935                |
| Adams, Walter Sydney, A.M., Sc.D., LL.D.<br>Astronomer, Director, Mount Wilson Observatory,<br>Pasadena, Calif.                                                   | 1915                |
| Aitken, Robert Grant, A.M., Sc.D., LL.D.<br>Astronomer, Director Emeritus, Lick Observatory.<br>1109 Spruce Street, Berkeley, Calif.                              | 1919                |
| Albright, William F., Ph.D., Litt.D., D.H.L., Th.D.<br>Orientalist and Archaeologist, Professor of Semitic<br>Languages, Johns Hopkins University, Baltimore, Md. | 1929                |
| Alexander, James W., A.M., Ph.D., A.A.<br>Professor of Mathematics, Institute for Advanced Study.<br>29 Cleveland Lane, Princeton, N. J.                          | 1928                |

|                                                                                                                                                                                                                     | Date of<br>Election |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Allen, Charles Elmer, Ph.D., Sc.D.<br>Professor of Botany, University of Wisconsin.<br>2014 Chamberlin Avenue, Madison, Wis.                                                                                        | 1922                |
| Anderson, Carl David, Ph.D.<br>Professor of Physics, California Institute<br>of Technology, Pasadena, Calif.                                                                                                        | 1938                |
| Andrews, Charles McLean, Ph.D., L.H.D., Litt.D., LL.D.<br>Professor Emeritus of American History, Yale<br>University. 424 St. Ronan Street, New Haven, Conn.                                                        | 1924                |
| Andrews, Donald Hatch, A.B., Ph.D.<br>Chairman, Chemistry Department, Director, Chemistry<br>Laboratory, Johns Hopkins University.<br>204 Southway, Guilford, Baltimore, Md.                                        | 1933                |
| Andrews, Roy Chapman, M.A., Sc.D.<br>Zoologist, Director, American Museum of Natural History,<br>New York, N. Y.                                                                                                    | 1927                |
| Angell, James Rowland, A.B., A.M., Ph.D., Litt.D., LL.D.<br>Psychologist, President Emeritus, Yale University;<br>Educational Counselor, National Broadcasting Company.<br>155 Blake Road, Hamden, New Haven, Conn. | 1924                |
| Armstrong, Edward Cooke, A.B., Ph.D., LL.D., L.H.D.<br>Professor of French Language, Princeton University.<br>26 Edgehill Street, Princeton, N. J.                                                                  | 1932                |
| Armstrong, Hamilton Fish, A.B.<br>Writer; Editor, <i>Foreign Affairs</i> .<br>45 East 65th Street, New York, N. Y.                                                                                                  | 1940                |
| Arthur, Joseph Charles, Sc.D., LL.D.<br>Professor Emeritus of Botany, Purdue University.<br>915 Columbia Street, Lafayette, Ind.                                                                                    | 1919                |
| Aydelotte, Frank, A.M., B.Litt., L.H.D., LL.D., D.Litt.,<br>D.C.L.<br>Educator, Director, Institute for Advanced Study,<br>Princeton, N. J.                                                                         | 1923                |
| Baekeland, Leo H., D.Sc., D.Nat.Sc., D.Ch., D.Ap.Sc.,<br>LL.D.<br>Chemist, Former President, Bakelite Corporation.<br>30 East 42nd Street, New York, N. Y.                                                          | 1935                |

## LIST OF MEMBERS

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Date of  
Election

- Bailey, Irving Widmer, A.B., M.F., Sc.D.** 1926  
Professor of Plant Anatomy, Harvard University.  
17 Buckingham Street, Cambridge, Mass.
- Bailey, Liberty Hyde, Litt.D., LL.D.** 1896  
Botanist, Professor Emeritus of Agriculture  
(Horticulture), Director (ret.), Bailey Hortorium,  
Cornell University, Ithaca, N. Y.
- Bancroft, Wilder Dwight, A.B., Ph.D., Sc.D., LL.D.** 1920  
Professor Emeritus of Physical Chemistry, Cornell  
University. 7 East Avenue, Ithaca, N. Y.
- Barbour, Thomas, Ph.D., Sc.D., S.D., Dr. en Ciencias** 1937  
Director, University Museum and Museum of Comparative  
Zoology, Professor of Zoology, Harvard University.  
278 Clarendon Street, Boston, Mass.
- Bartlett, Harley Harris, A.B.** 1929  
Chairman, Department of Botany, Director, Botanical  
Garden, University of Michigan. 538 Church Street,  
Ann Arbor, Mich.
- Barton, George Aaron, Ph.D., S.T.D., D.D., LL.D.** 1911  
Professor Emeritus of Semitic Languages, University of  
Pennsylvania; Professor Emeritus of New Testament  
Language and Literature, Divinity School of the  
Protestant Episcopal Church, Philadelphia.  
3610 Royal Palm Avenue, Coconut Grove, Fla.
- Bateman, Harry, M.A., Ph.D.** 1924  
Professor of Mathematics, Theoretical Physics and  
Aeronautics, California Institute of Technology,  
Pasadena, Calif.
- Beams, Jesse Wakefield, Ph.D.** 1939  
Professor of Physics, University of Virginia.  
Monroe Hill, University, Va.
- Beard, Charles Austin, LL.D., Ph.D.** 1936  
Historian, Formerly Professor of Politics, Columbia  
University. New Milford, Conn.
- Becker, Carl L., Ph.D., Litt.D.** 1936  
Professor Emeritus of History, Cornell University.  
109 West Upland Road, Ithaca, N. Y.

|                                                                                                                                                                                        | Date of<br>Election |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Beeson, Charles Henry, Ph.D.</b><br>Professor of Latin, University of Chicago.<br>1228 East 56th Street, Chicago, Ill.                                                              | 1940                |
| <b>Bell, Eric Temple, Ph.D.</b><br>Professor of Mathematics, California Institute<br>of Technology. 434 South Michigan Avenue,<br>Pasadena, Calif.                                     | 1937                |
| <b>Benedict, Francis Gano, Ph.D., Sc.D., M.D.</b><br>Physiologist, Director (ret.), Nutrition Laboratory,<br>Carnegie Institution of Washington (1907-37).<br>Machiasport, Maine.      | 1910                |
| <b>deBenneville, James S., A.B.</b><br>Chemist. 907 West Roosevelt Boulevard,<br>Philadelphia, Pa.                                                                                     | 1897                |
| <b>Berkey, Charles Peter, B.S., M.S., Ph.D., Sc.D.</b><br>Newberry Professor Emeritus of Geology, Columbia<br>University, New York, N. Y.                                              | 1928                |
| <b>Berry, Edward Wilber</b><br>Professor of Paleontology, Dean, Provost,<br>Johns Hopkins University, Baltimore, Md.                                                                   | 1919                |
| <b>Bigelow, Henry Bryant, Ph.D.</b><br>Director, Woods Hole Oceanographic Institution;<br>Professor of Zoology, Harvard University.<br>Museum of Comparative Zoology, Cambridge, Mass. | 1937                |
| <b>Birge, Edward Asahel, Ph.D., LL.D., Sc.D.</b><br>Zoologist, President Emeritus, University of Wisconsin.<br>2011 Van Hise Avenue, Madison, Wis.                                     | 1923                |
| <b>Birkhoff, George David, Ph.D., S.D., D. (hon.), LL.D.</b><br>Perkins Professor of Mathematics, Harvard University.<br>987 Memorial Drive, Cambridge, Mass.                          | 1921                |
| <b>Blackwelder, Eliot, Ph.D.</b><br>Professor and Executive Head, Department of Geology,<br>Stanford University, Calif.                                                                | 1939                |
| <b>Blakeslee, Albert Francis, A.M., Ph.D., D.Sc.</b><br>Botanist, Director, Department of Genetics, Carnegie<br>Institution of Washington, Cold Spring Harbor,<br>Long Island, N. Y.   | 1924                |

# LIST OF MEMBERS

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Date of  
Election

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Blegen, Carl William, Ph.D., M.A.</b><br>Professor of Classical Archaeology, Fellow of the<br>Graduate School of Arts and Sciences, University of<br>Cincinnati, Cincinnati, Ohio.                      | 1941 |
| <b>Bliss, Gilbert Ames, B.S., M.S., Ph.D., Sc.D.</b><br>Professor Emeritus of Mathematics, University of<br>Chicago, Chicago, Ill.                                                                         | 1926 |
| <b>Boas, Franz, Ph.D., M.D., LL.D., Sc.D.</b><br>Professor Emeritus of Anthropology, Columbia<br>University. Grantwood, Bergen County, N. J.                                                               | 1935 |
| <b>Bogert, Marston Taylor, A.B., Ph.B., Sc.D., LL.D., R.N.D.</b><br>Professor Emeritus of Organic Chemistry in Residence,<br>Columbia University, New York, N. Y.                                          | 1909 |
| <b>Bolton, Herbert Eugene, Ph.D., D.Litt., L.H.D., LL.D.</b><br>Sather Professor of History, Chairman, Department of<br>History, Director, Bancroft Library, University of<br>California, Berkeley, Calif. | 1937 |
| <b>Bonner, Campbell, A.M., Ph.D.</b><br>Professor of the Greek Language and Literature,<br>University of Michigan. 1025 Martin Place,<br>Ann Arbor, Mich.                                                  | 1938 |
| <b>Bowen, Ira Sprague, Ph.D.</b><br>Professor of Physics, California Institute of Technology,<br>Pasadena, Calif.                                                                                          | 1940 |
| <b>Bowen, Norman L., M.A., B.Sc., Ph.D., Sc.D., LL.D.</b><br>Geologist, Charles L. Hutchinson Distinguished Service<br>Professor of Petrology, University of Chicago, Chicago, Ill.                        | 1930 |
| <b>Bowman, Isaiah, B.S., Ph.D., M.A., D.Sc., LL.D.</b><br>Geographer, President, Johns Hopkins University,<br>Baltimore, Md.                                                                               | 1923 |
| <b>Bridgman, Percy Williams, A.M., Ph.D., Sc.D.</b><br>Physicist, Hollis Professor of Mathematics and<br>Natural Philosophy, Harvard University.<br>Research Laboratory of Physics, Cambridge, Mass.       | 1916 |
| <b>Briggs, Lyman J., Ph.D., Sc.D., D.Eng., LL.D.</b><br>Physicist, Director, National Bureau of Standards.<br>3208 Newark Street, Cleveland Park, Washington, D. C.                                        | 1935 |

|                                                                                                                                                                                               | Date of<br>Election |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Bronk, Detlev W., M.S., Ph.D., Sc.D.</b><br>Professor of Biophysics, Director, Eldridge Reeves<br>Johnson Foundation for Medical Physics,<br>University of Pennsylvania, Philadelphia, Pa. | 1934                |
| <b>Brooke, C. F. Tucker, M.A., B.Litt., Litt.D.</b><br>Sterling Professor of English, Yale University.<br>88 Cold Spring Street, New Haven, Conn.                                             | 1938                |
| <b>Brooks, Van Wyck, Litt.D.</b><br>Author and Literary Historian. Westport, Conn.                                                                                                            | 1939                |
| <b>Brubaker, Albert P., A.M., M.D., LL.D.</b><br>Professor Emeritus of Physiology, Jefferson Medical<br>College. 109 North 34th Street, Philadelphia, Pa.                                     | 1895                |
| <b>Bryant, William L.</b><br>Paleontologist, Director, Park Museum,<br>Providence, R. I.                                                                                                      | 1935                |
| <b>Buck, Carl Darling, A.B., Ph.D., Litt.D.</b><br>Professor Emeritus of Comparative Philology,<br>University of Chicago, Chicago, Ill.                                                       | 1923                |
| <b>Buddington, Arthur F., Ph.B., M.S., Ph.D.</b><br>Professor of Geology, Chairman, Department of Geology,<br>Princeton University, Princeton, N. J.                                          | 1931                |
| <b>Bumpus, Hermon Carey, Ph.D., Sc.D., LL.D.</b><br>Zoologist, Educator (ret.), Formerly Director, American<br>Museum of Natural History. Duxbury, Mass.                                      | 1909                |
| <b>Bush, Vannevar, Sc.D., Eng.D., LL.D.</b><br>Engineer, President, Carnegie Institution<br>of Washington, Washington, D. C.                                                                  | 1937                |
| <b>Butler, Nicholas Murray, Ph.D., LL.D.</b><br>President, Columbia University, New York, N. Y.                                                                                               | 1938                |
| <b>Byrd, Richard Evelyn, D.Eng., Sc.D., LL.D.</b><br>Geographer, Navigator, Rear-Admiral (ret.), United<br>States Navy. 9 Brimmer Street, Boston, Mass.                                       | 1930                |
| <b>Calvert, Philip Powell, Ph.D.</b><br>Professor Emeritus of Zoology, University of<br>Pennsylvania. P. O. Box 14, Cheyney, Pa.                                                              | 1918                |
| <b>Campbell, Douglas Houghton, Ph.D., LL.D.</b><br>Professor Emeritus of Botany, Stanford University, Calif.                                                                                  | 1910                |

# LIST OF MEMBERS

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|                                                                                                                                                                                                           | Date of<br>Election |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Cannon, Walter Bradford, A.M., M.D., Sc.D., LL.D.,<br/>Dr. (hon.)</b>                                                                                                                                  | 1908                |
| George Higginson Professor of Physiology,<br>Harvard Medical School, Boston, Mass.                                                                                                                        |                     |
| <b>Capps, Edward, Ph.D., LL.D., Litt.D., L.H.D.</b>                                                                                                                                                       | 1920                |
| Professor Emeritus of Classics, Princeton University,<br>Princeton, N. J.                                                                                                                                 |                     |
| <b>Carlson, Anton Julius, A.M., Ph.D., M.D., LL.D.</b>                                                                                                                                                    | 1928                |
| Professor of Physiology, University of Chicago.<br>5228 Greenwood Avenue, Chicago, Ill.                                                                                                                   |                     |
| <b>Carpenter, Rhys, Ph.D.</b>                                                                                                                                                                             | 1935                |
| Professor of Archaeology, Bryn Mawr College.<br>Jerry Run, R.D. 2, Downingtown, Pa.                                                                                                                       |                     |
| <b>Carrel, Alexis, M.D., Sc.D., LL.D.</b>                                                                                                                                                                 | 1909                |
| Surgeon, Biologist, Member Emeritus, Rockefeller<br>Institute for Medical Research, 66th Street and<br>York Avenue, New York, N. Y.                                                                       |                     |
| <b>Case, Ermine Cowles, A.B., A.M., M.S., Ph.D.</b>                                                                                                                                                       | 1931                |
| Professor Emeritus of Historical Geology and<br>Paleontology, University of Michigan, Ann Arbor, Mich.                                                                                                    |                     |
| <b>Castle, William Bosworth, M.D.</b>                                                                                                                                                                     | 1939                |
| Professor of Medicine, Harvard Medical School;<br>Associate Director, Thorndike Memorial Laboratory and<br>Director, Second and Fourth Medical Services<br>(Harvard), Boston City Hospital, Boston, Mass. |                     |
| <b>Castle, William Ernest, A.M., Ph.D., Sc.D., LL.D.</b>                                                                                                                                                  | 1910                |
| Professor Emeritus of Genetics, Harvard University;<br>Research Associate in Genetics, University of California.<br>Hilgard Hall, Berkeley, Calif.                                                        |                     |
| <b>Cather, Willa, Litt.D., LL.D.</b>                                                                                                                                                                      | 1934                |
| Author. Care A. A. Knopf, 501 Madison Avenue,<br>New York, N. Y.                                                                                                                                          |                     |
| <b>Cattell, James McKeen, Ph.D., LL.D., D.H.L., Sc.D.</b>                                                                                                                                                 | 1888                |
| Psychologist, Editor. Garrison, N. Y.                                                                                                                                                                     |                     |
| <b>Chamberlain, Joseph Perkins, Ph.D., LL.D.</b>                                                                                                                                                          | 1940                |
| Professor of Public Law, Columbia University.<br>8 Sutton Square, New York, N. Y.                                                                                                                         |                     |



|                                                                                                                                                                                                                               | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Chapman, Frank Michler, Sc.D.</b><br>Curator in Ornithology, American Museum of<br>Natural History, New York, N. Y.                                                                                                        | 1921                |
| <b>Chase, George Henry, A.B., A.M., Ph.D., L.H.D., Litt.D.</b><br>Professor of Archaeology, Dean of the University,<br>Harvard University. 1 Bryant Street, Cambridge, Mass.                                                  | 19                  |
| <b>Cheyney, Edward Potts, A.M., Litt.D., LL.D.</b><br>Professor Emeritus of European History, University of<br>Pennsylvania. R.F.D. 3, Media, Pa.                                                                             | 1904                |
| <b>Chinard, Gilbert, B.L., L.èsL., LL.D.</b><br>Professor of French Literature, Princeton University.<br>93 Mercer Street, Princeton, N. J.                                                                                   | 1932                |
| <b>Chittenden, Russell H., Ph.D., LL.D., Sc.D., M.D. (hon.)</b><br>Professor Emeritus of Physiological Chemistry, Director<br>Emeritus, Sheffield Scientific School, Yale University.<br>83 Trumbull Street, New Haven, Conn. | 1904                |
| <b>Clark, William Mansfield, Ph.D., Sc.D.</b><br>De Lamar Professor of Physiological Chemistry,<br>Johns Hopkins University, School of Medicine,<br>Baltimore, Md.                                                            | 1939                |
| <b>Cleland, Ralph Erskine, A.B., M.S., Ph.D.</b><br>Professor and Head, Department of Botany and<br>Bacteriology, Indiana University, Bloomington, Ind.                                                                       | 1932                |
| <b>Coble, Arthur Byron, Ph.D., LL.D.</b><br>Professor of Mathematics, University of Illinois.<br>702 W. Washington Boulevard, Urbana, Ill.                                                                                    | 1939                |
| <b>Cockerell, Theodore Dru Alison, D.Sc.</b><br>Professor Emeritus of Zoology, University of Colorado.<br>908 10th Street, Boulder, Colo.                                                                                     | 1928                |
| <b>Cole, Fay-Cooper, Ph.D., Sc.D.</b><br>Professor of Anthropology, Chairman of the Department,<br>University of Chicago. 5626 Dorchester Avenue,<br>Chicago, Ill.                                                            | 1941                |
| <b>Commons, John Rogers, LL.D.</b><br>Professor of Economics (ret.), University of Wisconsin.<br>P. O. 1498, Ft. Lauderdale, Fla.                                                                                             | 1936                |

# LIST OF MEMBERS

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Date of  
Election

- |                                                                                                                                                                    |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Compton, Arthur Holly, B.Sc., Ph.D., Sc.D., LL.D.</b><br>Professor of Physics, University of Chicago.<br>5637 Woodlawn Avenue, Chicago, Ill.                    | 1925 |
| <b>Compton, Karl Taylor, Ph.D., Sc.D., D.Eng., LL.D.</b><br>Physicist, President, Massachusetts Institute of<br>Technology, Cambridge, Mass.                       | 1923 |
| <b>Conant, James Bryant, Ph.D., LL.D.</b><br>Chemist, President, Harvard University.<br>17 Quincy Street, Cambridge, Mass.                                         | 1935 |
| <b>Conklin, Edwin Grant, Ph.D., Sc.D., LL.D.</b><br>Professor Emeritus of Biology, Princeton University,<br>Princeton, N. J.                                       | 1897 |
| <b>Coolidge, William David, Ph.D., Sc.D.</b><br>Physicist, Director, Research Laboratories of the General<br>Electric Company. 1480 Lenox Road, Schenectady, N. Y. | 1938 |
| <b>Corner, George Washington, M.D.</b><br>Director, Department of Embryology, Carnegie<br>Institution of Washington, Wolfe and Madison Streets,<br>Baltimore, Md.  | 1940 |
| <b>Corwin, Edward Samuel, Ph.D., LL.D., Litt.D.</b><br>Professor of Jurisprudence, Princeton University,<br>Princeton, N. J.                                       | 1936 |
| <b>Cottrell, Frederick Gardner, Ph.D., LL.D.</b><br>Chemist, Consultant to Research Corporation, New York.<br>3904 Ingomar Street, N.W., Washington, D. C.         | 1938 |
| <b>Crane, Robert Treat, Ph.D., LL.B.</b><br>Executive Director, Social Science Research Council.<br>1165 Fifth Avenue, New York, N. Y.                             | 1941 |
| <b>Cret, Paul Philippe, Sc.D., N.A.</b><br>Architect, Architects Building, Philadelphia, Pa.                                                                       | 1928 |
| <b>Crew, Henry, Ph.D.</b><br>Professor Emeritus of Physics, Northwestern University.<br>620 Library Place, Evanston, Ill.                                          | 1921 |
| <b>Crile, George, A.M., M.D., LL.D.</b><br>Surgeon, Director of Research, Cleveland Clinic<br>Foundation, Euclid Avenue at East 93d Street,<br>Cleveland, Ohio.    | 1912 |

|                                                                                                                                                                                                                                | Date of<br>Election |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Crocker, William, A.B., A.M., Ph.D.</b><br>Botanist, Managing Director, Boyce Thompson Institute<br>for Plant Research, Inc. 1086 North Broadway,<br>Yonkers, N. Y.                                                         | 1931                |
| <b>Cross, Whitman, B.S., Ph.D., Sc.D.</b><br>Geologist, United States Geological Survey (ret.).<br>101 East Kirke Street, Chevy Chase, Md.                                                                                     | 1915                |
| <b>Cross, Wilbur L., A.B., Ph.D., Litt.D., L.H.D., LL.D.</b><br>Governor of Connecticut (1932-38); Professor<br>Emeritus of English, Yale University; Editor of<br><i>The Yale Review</i> . 24 Edgehill Road, New Haven, Conn. | 1934                |
| <b>†Curtis, Heber Doust, A.M., Ph.D., Sc.D.</b><br>Astronomer, Director, The Observatory,<br>University of Michigan, Ann Arbor, Mich.                                                                                          | 1920                |
| <b>Dahlgren, Ulric, A.B., M.S.</b><br>Professor Emeritus of Biology, Princeton University.<br>7 Evelyn Place, Princeton, N. J.                                                                                                 | 1919                |
| <b>Daly, Reginald Aldworth, A.M., Ph.D., Sc.D.</b><br>Professor of Geology, Harvard University.<br>23 Hawthorn Street, Cambridge, Mass.                                                                                        | 1913                |
| <b>Damrosch, Walter Johannes, Mus.D.</b><br>Musician, Conductor. 168 East 71st Street,<br>New York, N. Y.                                                                                                                      | 1939                |
| <b>Darrach, William, A.B., A.M., M.D., Sc.D., LL.D.</b><br>Professor of Clinical Surgery, Dean Emeritus of<br>the Medical Faculty, Columbia University.<br>180 Fort Washington Avenue, New York, N. Y.                         | 1929                |
| <b>Darrow, Karl Kelchner, Ph.D.</b><br>Research Physicist, Bell Telephone Laboratories.<br>230 West 105th Street, New York, N. Y.                                                                                              | 1936                |
| <b>Davenport, Charles Benedict, Ph.D.</b><br>Biologist. Cold Spring Harbor, Long Island, N. Y.                                                                                                                                 | 1907                |
| <b>Davis, Bradley Moore, A.M., Ph.D.</b><br>Professor of Botany, University of Michigan,<br>Ann Arbor, Mich.                                                                                                                   | 1914                |

† Deceased January 8, 1942.

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Davis, Harvey Nathaniel, Ph.D., Sc.D., LL.D., D.Eng.</b><br>Mechanical Engineer, President, Stevens Institute of<br>Technology. Hloxie House, Castle Point, Hoboken, N. J.                    | 1935                |
| <b>Davis, John William, A.B., LL.B., LL.D.</b><br>Lawyer, United States Solicitor General (1913-18);<br>United States Ambassador to Great Britain (1918-21).<br>15 Broad Street, New York, N. Y. | 1923                |
| <b>Davisson, Clinton J., Ph.D., D.Sc.</b><br>Physicist, Bell Telephone Laboratories,<br>463 West Street, New York, N. Y.                                                                         | 1929                |
| <b>Day, Arthur L., Ph.D., Sc.D.</b><br>Geophysicist, Director (ret.), Geophysical Laboratory<br>(1907-36), Carnegie Institution of Washington.<br>1565 Old Georgetown Road, Bethesda, Md.        | 1912                |
| <b>Day, Edmund Ezra, Ph.D., LL.D.</b><br>President, Cornell University, Ithaca, N. Y.                                                                                                            | 1937                |
| <b>Delano, Frederic Adrian</b><br>Administrator (ret.); Vice-chairman, National<br>Resources Committee. 2400 16th Street,<br>Washington, D. C.                                                   | 1935                |
| <b>Dempster, Arthur Jeffrey, A.B., A.M., Ph.D., Sc.D.</b><br>Professor of Physics, University of Chicago.<br>5757 Kenwood Avenue, Chicago, Ill.                                                  | 1932                |
| <b>Derleth, Charles, Jr., C.E., LL.D.</b><br>Engineer, Dean, College of Engineering, University of<br>California, Berkeley, Calif.                                                               | 1936                |
| <b>Detwiler, Samuel Randall, Ph.D.</b><br>Professor of Anatomy, Columbia University,<br>New York, N. Y.                                                                                          | 1940                |
| <b>Dewey, John, A.B., Ph.D., LL.D.</b><br>Professor Emeritus of Philosophy, Columbia University.<br>1 West 89th Street, New York, N. Y.                                                          | 1911                |
| <b>Dickinson, John, Ph.D., LL.B., LL.D.</b><br>Professor of Law, University of Pennsylvania;<br>Counsel of the Pennsylvania Railroad.<br>Broad Street Station Building, Philadelphia, Pa.        | 1940                |

|                                                                                                                                                                                                             | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Dinsmoor, William Bell, Litt.D.</b><br>Professor of Archaeology, Columbia University.<br>9 East 77th Street, New York, N. Y.                                                                             | 1933                |
| <b>Dodds, Harold Willis, Ph.D., LL.D.</b><br>Administrator, President, Princeton University,<br>Princeton, N. J.                                                                                            | 1935                |
| <b>Douglass, Andrew Ellicott, D.Sc.</b><br>Professor of Astronomy and Dendrochronology,<br>University of Arizona, Tucson, Ariz.                                                                             | 1941                |
| <b>Dresden, Arnold, M.S., Ph.D.</b><br>Professor of Mathematics, Swarthmore College.<br>606 Elm Avenue, Swarthmore, Pa.                                                                                     | 1932                |
| <b>Duane, Morris, A.B., LL.B.</b><br>Lawyer, Duane, Morris and Heckscher Law Offices,<br>1617 Land Title Building, Philadelphia, Pa.                                                                        | 1940                |
| <b>DuBois, Eugene Floyd, M.D.</b><br>Professor of Medicine, Cornell University Medical<br>College; Physician-in-Chief, New York Hospital.<br>525 East 68th Street, New York, N. Y.                          | 1940                |
| <b>Duggar, Benjamin Minge, A.M., Ph.D.</b><br>Professor of Plant Physiology and Economic Botany,<br>University of Wisconsin, Madison, Wis.                                                                  | 1921                |
| <b>Dunn, Gano, M.S., E.E., D.Sc.</b><br>Engineer, President, J. G. White Engineering<br>Corporation; President, Cooper Union for the<br>Advancement of Science and Art. 80 Broad Street,<br>New York, N. Y. | 1924                |
| <b>†Du Pont, Francis I.</b><br>Chemist. P. O. Box 847, Wilmington, Del.                                                                                                                                     | 1930                |
| <b>Du Pont, Pierre Samuel, B.S.</b><br>Chemist, Manufacturer, E. I. du Pont de Nemours and<br>Company. Du Pont Building, Wilmington, Del.                                                                   | 1917                |
| <b>Durand, William Frederick, Ph.D., LL.D.</b><br>Professor Emeritus of Mechanical Engineering,<br>Stanford University, Calif.                                                                              | 1917                |

† Deceased March 16, 1942.

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| <b>Edgerton, Franklin, Ph.D.</b>                                                                                                                | 1935 |
| Professor of Sanskrit and Comparative Philology,<br>Yale University. 174 Blake Road, Hamden,<br>New Haven, Conn.                                |      |
| <b>Einstein, Albert, Ph.D., M.D.</b>                                                                                                            | 1930 |
| Professor of Theoretical Physics, Institute for<br>Advanced Study, Princeton, N. J.                                                             |      |
| <b>Eisenhart, Luther Pfahler, A.B., Ph.D., Sc.D., LL.D.</b>                                                                                     | 1913 |
| Professor of Mathematics, Dean, Graduate School,<br>Princeton University. Wyman House, Princeton, N. J.                                         |      |
| <b>Erlanger, Joseph, B.S., M.D., LL.D., Sc.D.</b>                                                                                               | 1927 |
| Professor of Physiology, Washington University.<br>4580 Scott Avenue, St. Louis, Mo.                                                            |      |
| <b>Evans, Griffith Conrad, Ph.D.</b>                                                                                                            | 1941 |
| Professor of Mathematics, University of California.<br>820 San Diego Road, Berkeley, Calif.                                                     |      |
| <b>Eyring, Henry, Ph.D.</b>                                                                                                                     | 1941 |
| Professor of Chemistry, Princeton University,<br>Princeton, N. J.                                                                               |      |
| <b>Farrand, Max, Ph.D., Litt.D., LL.D.</b>                                                                                                      | 1928 |
| Historian, Research Associate, Huntington Library and<br>Art Gallery. Reef Point, Bar Harbor, Maine.                                            |      |
| <b>Fels, Samuel S., LL.D.</b>                                                                                                                   | 1939 |
| President, Fels and Company, Paschall Oxygen Company.<br>39th and Walnut Streets, Philadelphia, Pa.                                             |      |
| <b>Ferguson, William Scott, A.M., Ph.D., LL.D., Litt.D.</b>                                                                                     | 1937 |
| MacLean Professor of Ancient and Modern History,<br>Dean, Faculty of Arts and Sciences, Harvard<br>University. 8 Scott Street, Cambridge, Mass. |      |
| <b>Fermi, Enrico, Ph.D.</b>                                                                                                                     | 1939 |
| Professor of Physics, Columbia University,<br>New York, N. Y.                                                                                   |      |
| <b>Fernald, Merritt Lyndon, S.B., D.C.L., D.Sc.</b>                                                                                             | 1936 |
| Professor of Natural History, Director, Gray Herbarium,<br>Harvard University, Cambridge, Mass.                                                 |      |
| <b>Fetter, Frank Albert, Ph.D., LL.D.</b>                                                                                                       | 1935 |
| Professor Emeritus of Political Economy, Princeton<br>University. 168 Prospect Avenue, Princeton, N. J.                                         |      |

|                                                                                                                                                                                                                                                                        | Date of<br>Election |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Fieser, Louis Frederick, Ph.D.</b><br>Sheldon Emery Professor of Organic Chemistry,<br>Harvard University. 27 Pinchurst Road, Belmont, Mass.                                                                                                                        | 1941                |
| <b>Fisher, Irving, B.A., Ph.D., LL.D.</b><br>Professor Emeritus of Economics, Yale University.<br>Box 1825, New Haven, Conn.                                                                                                                                           | 1927                |
| <b>Flexner, Simon, M.D., Sc.D., LL.D.</b><br>Pathologist, Director Emeritus, Rockefeller Institute<br>for Medical Research, 66th Street and York Avenue,<br>New York, N. Y.                                                                                            | 1901                |
| <b>Foote, Paul Darwin, A.B., M.A., Ph.D.</b><br>Physicist, Executive Vice-president, Gulf Research<br>and Development Company. P.O. Drawer 2038,<br>Pittsburgh, Pa.                                                                                                    | 1927                |
| <b>Forbes, Alexander, A.B., A.M., M.D.</b><br>Professor of Physiology, Harvard Medical School,<br>Shattuck Street, Boston, Mass.                                                                                                                                       | 1931                |
| <b>Ford, Guy Stanton, Ph.D., Litt.D., LL.D.</b><br>Historian Editor, <i>American Historical Review</i> .<br>Study 274, Library of Congress Annex, Washington, D. C.                                                                                                    | 1939                |
| <b>Fosdick, Raymond Blaine, B.A., M.A., LL.B., LL.D.</b><br>Lawyer, President, Rockefeller Foundation and<br>General Education Board, 49 West 49th Street,<br>New York, N. Y.                                                                                          | 1930                |
| <b>Fox, Dixon Ryan, Ph.D., Pd.D., L.H.D., Litt.D., LL.D.,<br/>D.C.L.</b><br>Historian, President, Union College, Schenectady, N. Y.                                                                                                                                    | 1935                |
| <b>†Fox, Herbert, A.B., M.D.</b><br>Pathologist to the Philadelphia Zoological Society;<br>Professor of Comparative Pathology, University of<br>Pennsylvania; Director, William Pepper Laboratory,<br>Hospital of the University of Pennsylvania,<br>Philadelphia, Pa. | 1932                |
| <b>Franck, James, Ph.D., LL.D.</b><br>Professor of Physical Chemistry,<br>University of Chicago, Chicago, Ill.                                                                                                                                                         | 1937                |

† Deceased February 26, 1942.

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| <b>Frankfurter, Felix, LL.B.</b>                                                                                         | 1939 |
| Associate Justice, Supreme Court of the<br>United States, Washington, D. C.                                              |      |
| <b>Frost, Robert, L.H.D., Litt.D.</b>                                                                                    | 1937 |
| Poet, Professor of English, Amherst College.<br>South Shaftsbury, Vt.                                                    |      |
| <b>Gaposchkin, Cecilia Payne, B.A., Ph.D.</b>                                                                            | 1936 |
| Astronomer, Harvard College Observatory,<br>Cambridge, Mass.                                                             |      |
| <b>Gasser, Herbert Spencer, A.M., M.D., Sc.D.</b>                                                                        | 1937 |
| Physiologist, Director, Rockefeller Institute for<br>Medical Research, 66th Street and York Avenue,<br>New York, N. Y.   |      |
| <b>Gates, Thomas Sovereign, Ph.B., LL.B., LL.D.</b>                                                                      | 1930 |
| Administrator, President, University of Pennsylvania,<br>Philadelphia, Pa.                                               |      |
| <b>Gay, Edwin Francis, A.B., Ph.D., Litt.D., LL.D.</b>                                                                   | 1932 |
| Professor Emeritus of Economic History, Harvard<br>University. 2040 Pasqual Street, Pasadena, Calif.                     |      |
| <b>Giauque, William Francis, Ph.D., Sc.D.</b>                                                                            | 1940 |
| Professor of Chemistry, University of California,<br>Berkeley, Calif.                                                    |      |
| <b>Gies, William J., B.S., Ph.B., M.S., Ph.D., Sc.D., LL.D.</b>                                                          | 1915 |
| Professor of Biological Chemistry, Columbia University<br>Medical School. 630 West 168th Street, New York, N. Y.         |      |
| <b>Gifford, Walter Sherman, A.B., LL.D., D.Sc., D.C.L.</b>                                                               | 1931 |
| Administrator, President, American Telephone and<br>Telegraph Company. 195 Broadway, New York, N. Y.                     |      |
| <b>Gomberg, Moses, B.S., Sc.D., LL.D.</b>                                                                                | 1920 |
| Professor Emeritus of Chemistry, University of<br>Michigan. 712 Onondaga Street, Ann Arbor, Mich.                        |      |
| <b>Goodrich, Herbert Funk, A.B., LL.B., LL.D.</b>                                                                        | 1937 |
| Judge, United States Circuit Court of Appeals,<br>Third Circuit. 7701 Cresheim Road,<br>Chestnut Hill, Philadelphia, Pa. |      |
| <b>Goodspeed, Arthur Willis, A.B., Ph.D.</b>                                                                             | 1896 |
| Professor Emeritus of Physics, University of<br>Pennsylvania. 4304 Chestnut Street, Philadelphia, Pa.                    |      |



|                                                                                                                                                                                                                                                    | Date of<br>Election |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Graham, Evarts Ambrose, M.D., Sc.D., LL.D., M.S.</b><br>Professor of Surgery, Washington University School<br>of Medicine, St. Louis, Mo.                                                                                                       | 1941                |
| <b>Graves, Frank Pierrepont, Ph.D., Litt.D., L.H.D., LL.D.,<br/>J.U.D., D.C.L.</b><br>Educator, President, University of the State of New York;<br>State Commissioner of Education, Emeritus.<br>58 South Swan Street, Albany, N. Y.               | 1927                |
| <b>Greene, Evarts B., Ph.D., Litt.D., L.H.D., LL.D.</b><br>Professor Emeritus of American History, Columbia<br>University. Box 194, Croton-on-Hudson, N. Y.                                                                                        | 1931                |
| <b>Gregory, Herbert Ernest, Ph.D., D.Sc.</b><br>Silliman Professor Emeritus of Geology, Yale University;<br>Director Emeritus, Bernice P. Bishop Museum,<br>Honolulu, Hawaii.                                                                      | 1923                |
| <b>Gregory, William King, A.M., Ph.D., D.Sc.</b><br>Professor of Vertebrate Paleontology, Columbia<br>University; Curator, Department of Comparative<br>Anatomy, Department of Ichthyology, American<br>Museum of Natural History, New York, N. Y. | 1925                |
| <b>Gulick, Charles Burton, Ph.D.</b><br>Eliot Professor Emeritus of Greek Literature, Harvard<br>University. 59 Fayerweather Street, Cambridge, Mass.                                                                                              | 1940                |
| <b>Haney, John Louis, A.B., A.M., B.S., Ph.D., LL.D.</b><br>Educator, President, Central High School of Philadelphia.<br>6419 Woodbine Avenue, Overbrook, Philadelphia, Pa.                                                                        | 1929                |
| <b>Harkins, William Draper, A.B., Ph.D.</b><br>Professor of Physical Chemistry, University of<br>Chicago. 5437 Ellis Avenue, Chicago, Ill.                                                                                                         | 1925                |
| <b>Harper, Robert A., M.A., Ph.D., D.Sc.</b><br>Professor Emeritus of Botany, Columbia University,<br>New York, N. Y.                                                                                                                              | 1909                |
| <b>Harrison, Ross G., M.A., Ph.D., M.D., Sc.D.</b><br>Professor Emeritus of Biology, Yale University;<br>Chairman, National Research Council.<br>142 Huntington Street, New Haven, Conn.                                                           | 1913                |

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| <b>Harvey, E. Newton, Ph.D.</b><br>Henry Fairfield Osborn Professor of Biology,<br>Princeton University, Princeton, N. J.                                                           | 1929 |
| <b>Hastings, Albert Baird, Ph.D., Sc.D.</b><br>Hamilton Kuhn Professor of Biological Chemistry,<br>Harvard Medical School. 29 Chestnut Place,<br>Brookline, Mass.                   | 1941 |
| <b>Hawk, Philip Bovier, M.S., Ph.D.</b><br>Chemist, President and Director, Food Research<br>Laboratories, Inc., of New York. 48-14 Thirty-Third<br>Street, Long Island City, N. Y. | 1915 |
| <b>Hayes, Carlton Joseph Huntley, Ph.D., Litt.D., LL.D.,<br/>L.H.D.</b><br>Seth Low Professor of History, Columbia University.<br>427 West 117th Street, New York, N. Y.            | 1940 |
| <b>Hayward, Nathan, A.B., S.B.</b><br>President (ret.), The Franklin Institute.<br>12 South Twelfth Street, Philadelphia, Pa.                                                       | 1937 |
| <b>Heiser, Victor George, A.B., M.D., Sc.D., LL.D.</b><br>Physician (ret.). Bantam, Conn.                                                                                           | 1918 |
| <b>†Henderson, Lawrence J., M.D., ScD., Dr.(hon.)</b><br>Abbott and James Lawrence Professor of Chemistry,<br>Harvard University. 4 Willard Street, Cambridge, Mass.                | 1921 |
| <b>Henderson, Robert, B.A., D.Sc.</b><br>Mathematician, Actuarial Consultant.<br>Crown Point, Essex County, N. Y.                                                                   | 1927 |
| <b>Henderson, Yandell, Ph.D.</b><br>Professor Emeritus of Physiology, Yale University.<br>440 Prospect Street, New Haven, Conn.                                                     | 1935 |
| <b>Hendrickson, George Lincoln, A.B., L.H.D.</b><br>Professor of Greek and Latin Literature,<br>851 Branford College, Yale University, New Haven, Conn.                             | 1932 |
| <b>Hisaw, Frederick Lee, Ph.D., LL.D.</b><br>Professor of Zoology, Harvard University,<br>Cambridge, Mass.                                                                          | 1940 |

† Deceased February 10, 1942.

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Hobbs, William Herbert, A.M., Ph.D., D.Eng., LL.D.<br>Professor Emeritus of Geology, University of Michigan,<br>Ann Arbor, Mich.                                                                                                      | 1909                |
| Holland, Leicester Bodine, B.S., Ph.D.<br>Chief, Division of Fine Arts, Library of Congress.<br>415 West Price Street, Germantown, Philadelphia, Pa                                                                                   | 1931                |
| Hooton, Earnest A., B.A., M.A., Ph.D., B.Litt., Sc.D.<br>Professor of Anthropology, Curator of Somatology,<br>Peabody Museum, Harvard University, Cambridge, Mass.                                                                    | 1931                |
| Hoover, Herbert, Dr. Eng., M.D., Sc.D., LL.D., D.C.L.,<br>J.D.<br>Engineer, Thirty-first President of the United States.<br>Stanford University, Calif.                                                                               | 1918                |
| Hopkins, B Smith, Ph.D., D.Sc., LL.D.<br>Professor Emeritus of Inorganic Chemistry,<br>University of Illinois, Urbana, Ill                                                                                                            | 1927                |
| Hopkinson, Edward, Jr., A.B., LL.B.<br>Lawyer, Banker, Trustee, University of Pennsylvania.<br>8700 Montgomery Avenue, Chestnut Hill,<br>Philadelphia, Pa.                                                                            | 1938                |
| Howard, Leland Ossian, M.D., Ph.D., Sc.D., LL.D.<br>Zoologist, Consulting Entomologist, United States<br>Public Health Service. Bureau of Entomology,<br>United States Department of Agriculture,<br>Washington, D. C.                | 1911                |
| Howell, William Henry, A.B., Ph.D., M.D., Sc.D., LL.D.<br>Professor Emeritus of Physiology, Formerly Dean,<br>Medical Faculty and Director, School of Hygiene,<br>Johns Hopkins University. 112 St. Dunstan's Road,<br>Baltimore, Md. | 1903                |
| Hrdlička, Ales, M.D., Sc.D.<br>Curator, Division of Physical Anthropology,<br>United States National Museum, Washington, D. C.                                                                                                        | 1918                |
| Hubble, Edwin P., B.Sc., Ph.D., B.A., D.Sc., LL.D.<br>Astronomer, Mount Wilson Observatory, Pasadena, Calif.                                                                                                                          | 1929                |

# LIST OF MEMBERS

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Date of  
Election

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Hudson, Manley Ottmer, A.M., LL.B., S.J.D., LL.D.<br/>D.C.L.</b>                                                                                                                     | 1941 |
| Judge, Permanent Court of International Justice;<br>Bemis Professor of International Law, Harvard<br>University, Cambridge, Mass.                                                       |      |
| <b>Huebner, Solomon Stephen, Ph.D., Sc.D.</b>                                                                                                                                           | 1930 |
| Economist, Professor of Insurance and Commerce,<br>University of Pennsylvania; President, American College<br>of Life Underwriters. 697 South Highland Avenue,<br>Merion, Pa.           |      |
| <b>Hughes, Charles Evans, A.B., A.M., LL.B., LL.D., D.C.L.</b>                                                                                                                          | 1926 |
| Chief Justice of the United States (ret.).<br>2223 R Street, N.W., Washington, D. C.                                                                                                    |      |
| <b>Hulett, George A., A.B., Ph.D.</b>                                                                                                                                                   | 1913 |
| Professor Emeritus of Physical Chemistry, Princeton<br>University. 44 Washington Road, Princeton, N. J.                                                                                 |      |
| <b>Humphreys, William Jackson, A.B., C.E., Ph.D.</b>                                                                                                                                    | 1929 |
| Professor Emeritus of Meteorological Physics,<br>George Washington University; Collaborator,<br>United States Weather Bureau, Washington, D. C.                                         |      |
| <b>Hunsaker, Jerome Clarke, D.Sc.</b>                                                                                                                                                   | 1940 |
| Head, Department of Mechanical Engineering,<br>Massachusetts Institute of Technology; Professor in<br>Charge, Guggenheim Aeronautical Laboratory.<br>10 Louisburg Square, Boston, Mass. |      |
| <b>Hunter, Walter Samuel, Ph.D.</b>                                                                                                                                                     | 1941 |
| Professor of Psychology, Director, Psychological<br>Laboratory, Brown University. 61 Prospect Street,<br>Providence, R. I.                                                              |      |
| <b>Huntington, Edward Vermilye, A.B., A.M., Ph.D., Sc.D.</b>                                                                                                                            | 1933 |
| Mathematician, Professor Emeritus of Mechanics, Harvard<br>University. 48 Highland Street, Cambridge, Mass.                                                                             |      |
| <b>Ives, Herbert E., B.S., Ph.D., Sc.D.</b>                                                                                                                                             | 1917 |
| Physicist, Bell Telephone Laboratories.<br>32 Laurel Place, Montclair, N. J.                                                                                                            |      |
| <b>Jackson, Dugald Caleb, C.E., D.Sc., D.Eng.</b>                                                                                                                                       | 1931 |
| Professor Emeritus of Electrical Engineering,<br>Massachusetts Institute of Technology.<br>5 Mercer Circle, Cambridge, Mass.                                                            |      |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Jacobs, Merkel Henry, A.B., Ph.D.</b><br>Professor of General Physiology, University of<br>Pennsylvania, Philadelphia, Pa.                                                                                             | 1930                |
| <b>Jayne, Horace Howard Furness, A.B., A.M.</b><br>Archaeologist, Vice-director, Metropolitan Museum of Art,<br>New York, N. Y.                                                                                           | 1934                |
| <b>Jenks, John Story, M.A.</b><br>Banker. 1421 Chestnut Street, Philadelphia, Pa.                                                                                                                                         | 1936                |
| <b>Jennings, Herbert S., Ph.D., Sc.D., LL.D.</b><br>Professor Emeritus of Zoology, Johns Hopkins University;<br>Research Associate, University of California,<br>Los Angeles, Calif.                                      | 1907                |
| <b>Jessup, Philip C., LL.B., LL.D., Ph.D.</b><br>Professor of International Law, Columbia<br>University, New York, N. Y.                                                                                                  | 1939                |
| <b>Jewett, Frank Baldwin, A.B., Ph.D., D.Sc., D.Eng., LL.D.</b><br>Vice-president, American Telephone and Telegraph<br>Company; Chairman of the Board, Bell Telephone<br>Laboratories, Inc. 195 Broadway, New York, N. Y. | 1938                |
| <b>Johnson, Douglas, Ph.D., D.Sc.</b><br>Geologist and Geographer, Professor of Physiography,<br>Columbia University, New York, N. Y.                                                                                     | 1920                |
| <b>Johnson, Eldridge Reeves, A.E.D.</b><br>Industrialist, Founder, Victor Talking Machine Company.<br>608 West Jersey Trust Building, Camden, N. J.                                                                       | 1928                |
| <b>Johnson, Emory R., Litt.M., Ph.D., Sc.D.</b><br>Professor Emeritus of Transportation and Commerce,<br>Logan Hall, University of Pennsylvania,<br>Philadelphia, Pa.                                                     | 1915                |
| <b>Jones, Howard Mumford, Litt.D., L.H.D.</b><br>Professor of English, Harvard University,<br>Cambridge, Mass.                                                                                                            | 1941                |
| <b>Jones, Lewis Ralph, Ph.B., Ph.D., Sc.D., LL.D.</b><br>Professor Emeritus of Plant Pathology,<br>University of Wisconsin, Madison, Wis.                                                                                 | 1925                |

- Joslin, Elliott Proctor, B.A., M.A., Ph.B., M.D.** 1925  
Physician, Clinical Professor Emeritus of Medicine,  
Harvard Medical School. 81 Bay State Road,  
Boston, Mass.
- Kármán, Theodor von, Ph.D., D.Eng., D.Sc.** 1941  
Professor of Aeronautics, Director, Guggenheim  
Aeronautics Laboratory, California Institute of  
Technology. 1501 South Marengo Avenue,  
Pasadena, Calif.
- Kemmerer, Edwin Walter, A.B., Ph.D., LL.D., D.C.S.,  
D.Sc.** 1932  
Political Economist, Professor of International Finance,  
Princeton University. 161 Hodge Road,  
Princeton, N. J.
- Keppel, Frederick Paul, Litt.D., LL.D.** 1938  
President (ret.), Carnegie Corporation of New York,  
522 Fifth Avenue, New York, N. Y.
- Kettering, Charles Franklin, M.E., E.E., D.Eng., D.Sc.** 1930  
Research Engineer, Vice-president, General Motors  
Corporation; General Director, Research Laboratories  
Division, General Motors Corporation.  
Ridgely Terrace, Dayton, Ohio.
- Keyes, Frederick George, M.S., Ph.D., D.Sc.** 1938  
Professor and Head, Department of Chemistry,  
Massachusetts Institute of Technology.  
15 Berkeley Street, Cambridge, Mass.
- Kidder, Alfred Vincent, Ph.D., LL.D.** 1934  
Archaeologist, Chairman, Division of Historical  
Research, Carnegie Institution of Washington.  
10 Frisbie Place, Cambridge, Mass.
- Kistiakowsky, George Bogdan, Ph.D.** 1940  
Professor of Chemistry, Harvard University.  
12 Oxford Street, Cambridge, Mass.
- Kline, John Robert, Ph.D.** 1941  
Professor of Mathematics, Chairman of the Department,  
University of Pennsylvania. 529 Riverview Avenue,  
Swarthmore, Pa.

|                                                                                                                                                                                                 | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Kofoed, Charles A., A.M., Ph.D., Sc.D., LL.D.</b><br>Professor Emeritus of Zoology, University of California,<br>Berkeley, Calif.                                                            | 1924                |
| <b>Köhler, Wolfgang, Ph.D.</b><br>Professor of Psychology, Swarthmore College.<br>603 Elm Avenue, Swarthmore, Pa.                                                                               | 1939                |
| <b>Kraus, Charles August, Ph.D.</b><br>Professor of Chemistry and Director of Research<br>in Chemistry, Brown University.<br>92 Keene Street, Providence, R. I.                                 | 1939                |
| <b>Kroeber, Alfred Louis, Ph.D.</b><br>Professor of Anthropology, Director, Anthropological<br>Museum, University of California, Berkeley, Calif.                                               | 1941                |
| <b>Lamb, Arthur Becket, Ph.D., D.Sc.</b><br>Professor of Chemistry, Dean, Graduate School of Arts<br>and Sciences, Harvard University.<br>12 Oxford Street, Cambridge Mass.                     | 1936                |
| <b>Lamont, Thomas William, A.B., LL.D.</b><br>Banker, Trustee. 23 Wall Street, New York, N. Y.                                                                                                  | 1932                |
| <b>Lampland, Carl O., A.B., A.M., LL.D.</b><br>Astronomer, Lowell Observatory, Flagstaff, Ariz.                                                                                                 | 1931                |
| <b>Lancaster, Henry Carrington, M.A., Ph.D.</b><br>Professor of French Literature, Chairman, Department<br>of Romance Languages, Johns Hopkins University.<br>604 Edgevale Road, Baltimore, Md. | 1938                |
| <b>Landsteiner, Karl, M.D., D.Sc.</b><br>Pathologist, Rockefeller Institute for Medical Research.<br>25 East 86th Street, New York, N. Y.                                                       | 1935                |
| <b>Langmuir, Irving, M.A., Ph.D., Sc.D., LL.D.</b><br>Chemist and Physicist, Associate Director,<br>Research Laboratory, General Electric Company,<br>Schenectady, N. Y.                        | 1922                |
| <b>Lashley, Karl Spencer, M.S., Ph.D., Sc.D.</b><br>Research Professor of Neuropsychology, Harvard<br>University, Cambridge, Mass.                                                              | 1938                |

## LIST OF MEMBERS

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Date of  
Election

|                                                                                                                                         |      |
|-----------------------------------------------------------------------------------------------------------------------------------------|------|
| Lawrence, Ernest Orlando, B.S., A.M., Ph.D., Sc.D.,<br>LL.D.                                                                            | 1937 |
| Professor of Physics, Director, Radiation Laboratory,<br>University of California, Berkeley, Calif.                                     |      |
| Lawson, Andrew Cowper, M.A., Ph.D., Sc.D., LL.D.                                                                                        | 1925 |
| Professor of Mineralogy and Geology (ret.),<br>University of California, Berkeley, Calif.                                               |      |
| Leeds, Morris Evans, D.Eng.                                                                                                             | 1940 |
| Chairman of the Board, Leeds and Northrup Company.<br>1025 Westview Street, Philadelphia, Pa.                                           |      |
| Lefschetz, Solomon, M.E., Ph.D.                                                                                                         | 1929 |
| Research Professor of Mathematics, Princeton University.<br>129 Broadmead, Princeton, N. J.                                             |      |
| Leith, Charles Kenneth, B.S., Ph.D., LL.D., D.Sc.                                                                                       | 1926 |
| Professor of Geology, University of Wisconsin.<br>Moraine, Old Sauk Road, Madison, Wis.                                                 |      |
| Leland, Waldo G., A.B., A.M., Litt.D., L.H.D.                                                                                           | 1931 |
| Historian, Director, American Council of<br>Learned Societies, 1219 Sixteenth Street, N.W.,<br>Washington, D. C.                        |      |
| Leuschner, Armin Otto, A.B., Ph.D., Sc.D., LL.D.                                                                                        | 1924 |
| Professor of Astronomy, Director Emeritus,<br>Students' Observatory, University of California.<br>1816 Scenic Avenue, Berkeley, Calif.  |      |
| Leverett, Frank, B.Sc., Sc.D.                                                                                                           | 1924 |
| Geologist (ret.), United States Geological Survey.<br>1724 South University Avenue, Ann Arbor, Mich.                                    |      |
| Lewis, Gilbert Newton, A.B., A.M., Ph.D., D.Sc.                                                                                         | 1918 |
| Professor of Chemistry, Dean, College of Chemistry,<br>University of California, Berkeley, Calif.                                       |      |
| Lillie, Frank Rattray, B.A., Ph.D., Sc.D.                                                                                               | 1916 |
| Andrew MacLeish Distinguished Service Professor<br>Emeritus of Embryology, University of Chicago.<br>5801 Kenwood Avenue, Chicago, Ill. |      |
| Lillie, Ralph Stayer, B.A., Ph.D., Sc.D.                                                                                                | 1937 |
| Professor of General Physiology, University of Chicago.<br>5545 Kenwood Avenue, Chicago, Ill.                                           |      |



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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Lingelbach, William E., B.A., Ph.D., Litt.D.</b><br>Professor of Modern European History,<br>University of Pennsylvania.<br>4304 Osage Avenue, Philadelphia, Pa.                                                                        | 1916                |
| <b>Livingston, Burton E., B.S., Ph.D.</b><br>Professor of Plant Physiology and Forest Ecology,<br>Director, Laboratory of Plant Physiology,<br>Johns Hopkins University. Riderwood, Md.                                                    | 1933                |
| <b>Loeb, Leo, M.D.</b><br>Professor Emeritus and Research Professor of<br>Pathology, Washington University Medical School,<br>St. Louis, Mo.                                                                                               | 1910                |
| <b>Long, Esmond Ray, Ph.D., M.D.</b><br>Director, Henry Phipps Institute, Professor of<br>Pathology, University of Pennsylvania; President,<br>Wistar Institute. Henry Phipps Institute, Seventh<br>and Lombard Streets, Philadelphia, Pa. | 1940                |
| <b>Loomis, Alfred Lee, A.B., LL.B., D.Sc., M.Sc.</b><br>Physicist, Director, Loomis Laboratories.<br>Tuxedo Park, N. Y.                                                                                                                    | 1930                |
| <b>Lovejoy, Arthur Oncken, A.B., A.M., LL.D.</b><br>Professor of Philosophy, Johns Hopkins University.<br>827 Park Avenue, Baltimore, Md.                                                                                                  | 1932                |
| <b>Lovett, Edgar Odell, Ph.D., Sc.D., LL.D.</b><br>Mathematician and Astronomer,<br>President, The Rice Institute, Houston, Texas.                                                                                                         | 1904                |
| <b>Lowell, Abbott Lawrence, A.B., LL.B., Ph.D., Litt.D.,<br/>LL.D.</b><br>President Emeritus, Harvard University.<br>171 Marlborough Street, Boston, Mass.                                                                                 | 1909                |
| <b>Lowes, John Livingston, Ph.D., LL.D., Litt.D., L.H.D.</b><br>Francis Lee Higginson Professor Emeritus of English<br>Literature, Harvard University. 984 Memorial Drive,<br>Cambridge, Mass.                                             | 1934                |
| <b>Lydenberg, Harry Miller, L.H.D., Litt.D.</b><br>Formerly Director, New York Public Library;<br>Director, Benjamin Franklin Library.<br>Paseo de la Reforma 27, Mexico, D. F., Mexico.                                                   | 1939                |

- Lyman, Theodore, A.M., Ph.D.**  
Professor Emeritus of Physics, Director, Jefferson  
Laboratory, Harvard University, Cambridge, Mass.
- McClelland, George William, Ph.D., LL.D.** 1941  
Professor of English, Provost, University of  
Pennsylvania. 4037 Pine Street, Philadelphia, Pa.
- McClung, Clarence E., Ph.G., A.B., A.M., Ph.D., Sc.D.** 1913  
Professor Emeritus of Zoology, University of  
Pennsylvania, Philadelphia, Pa.
- McClure, Charles Freeman Williams, A.B., A.M., Sc.D.** 1897  
Professor Emeritus of Comparative Anatomy,  
Princeton University. 1 Battle Road, Princeton, N. J.
- MacCurdy, George Grant, A.B., A.M., Ph.D.** 1925  
Professor Emeritus of Anthropology, Yale University;  
Director, American School of Prehistoric Research,  
Old Lyme, Conn.
- McDaniel, Walton Brooks, A.B., A.M., Ph.D.** 1917  
Professor Emeritus of Latin Language and Literature,  
University of Pennsylvania. 4082 Malaga Avenue,  
Coconut Grove, Fla.
- MacDougal, Daniel Trembly, M.A., Ph.D., LL.D.** 1916  
Director (ret.), Laboratory for Plant Physiology,  
Carnegie Institution of Washington. Carmel, Calif.
- Macfarlane, John Muirhead, B.S., Sc.D., LL.D., Litt.D.** 1892  
Professor Emeritus of Botany, University of Pennsylvania.  
"The Windmill," Paoli, Pa.
- MacNider, William de Berniere, M.D., Sc.D., LL.D.** 1939  
Kenan Research Professor of Pharmacology,  
University of North Carolina, Chapel Hill, N. C.
- McGregor, James Howard, B.S., M.A., Ph.D.** 1929  
Professor of Zoology, Columbia University,  
New York, N. Y.
- McIlwain, Charles Howard, A.M., Ph.D., LL.D.** 1938  
Eaton Professor of the Science of Government, Harvard  
University. 48 Village Hill Road, Belmont, Mass.
- Magie, William Francis, A.M., Ph.D., LL.D., D.Sc.** 1896  
Professor Emeritus of Physics, Princeton University.  
118 Library Place, Princeton, N. J.

|                                                                                                                                                                                          | Date of<br>Election |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Mark, Edward Laurens, A.M., Ph.D., LL.D.</b><br>Professor Emeritus of Anatomy, Harvard University.<br>109 Irving Street, Cambridge, Mass.                                             | 1907                |
| <b>Mason, William Smith, Ph.B., A.M., L.H.D., D.Litt.</b><br>Man of Affairs, Collector of Frankliniana, University<br>Trustee. 1401 Ridge Avenue, Evanston, Ill.                         | 1928                |
| <b>Mather, Frank Jewett, Jr., Ph.D., L.H.D.</b><br>Professor Emeritus of Art and Archaeology,<br>Princeton University. Washington Crossing, Pa.                                          | 1940                |
| <b>Matthews, Albert, A.B.</b><br>Modern Philologist and Historian.<br>19 St. Botolph Street, Boston, Mass.                                                                               | 1899                |
| <b>Mees, Charles Edward Kenneth, D.Sc.</b><br>Chemist, Vice-president in Charge of Research<br>and Development, Eastman Kodak Company,<br>Rochester, N. Y.                               | 1937                |
| <b>Meritt, Benjamin Dean, Ph.D., D.Litt., LL.D.</b><br>Professor of Greek Epigraphy, Institute for Advanced<br>Study, Princeton, N. J.                                                   | 1938                |
| <b>Merriam, Charles Edward, Ph.D., LL.D.</b><br>Professor of Political Science, University of Chicago.<br>6041 University Avenue, Chicago, Ill.                                          | 1935                |
| <b>Merriam, John C., B.S., Ph.D., Sc.D., LL.D.</b><br>Paleontologist, President Emeritus, Carnegie Institution<br>of Washington. California Institute of Technology,<br>Pasadena, Calif. | 1914                |
| <b>Merrill, Elmer Drew, B.S., M.S., Sc.D., LL.D.</b><br>Professor of Botany, Administrator of Botanical<br>Collections, Harvard University. Arnold Arboretum,<br>Jamaica Plain, Mass.    | 1932                |
| <b>Merrill, Paul Willard, Ph.D.</b><br>Astronomer, Mount Wilson Observatory, Carnegie<br>Institution of Washington, Pasadena, Calif.                                                     | 1939                |
| <b>Metz, Charles William, Ph.D.</b><br>Professor of Zoology, Director, Zoological Laboratory,<br>University of Pennsylvania, Philadelphia, Pa.                                           | 1941                |

## LIST OF MEMBERS

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Date of  
Election

- Miller, Gerrit Smith, Jr., A.B.** 1927  
Associate in Biology, United States  
National Museum, Washington, D. C.
- Miller, Hunter, LL.B., LL.M., D.C.L.** 1928  
International Law, Editor of *The Treaties*, Department  
of State. Craiglands, R. M. D. 1, Victoria, B. C., Canada.
- Miller, John Anthony, A.M., Ph.D., LL.D.** 1915  
Professor Emeritus of Astronomy, Director Emeritus,  
Sproul Observatory, Swarthmore College.  
Wallingford, Pa.
- Millikan, Robert Andrews, Ph.D., LL.D., Sc.D.** 1914  
Director, Norman Bridge Laboratory of Physics,  
Chairman, Executive Council, California Institute  
of Technology, Pasadena, Calif.
- Minot, George Richards, A.B., M.D., S.D.** 1935  
Professor of Medicine, Harvard University; Director,  
Thorndike Memorial Laboratory, and Visiting Physician,  
Boston City Hospital, Boston, Mass.
- Mitchell, Howard Hawks, Ph.D.** 1925  
Professor of Mathematics, University of Pennsylvania.  
416 Sycamore Avenue, Merion, Pa.
- Mitchell, Samuel Alfred, Ph.D., LL.D.** 1923  
Professor of Astronomy, Director, Leander McCormick  
Observatory, University of Virginia, University, Va.
- Mitchell, Wesley Clair, A.B., Ph.D., LL.D., D.Litt.** 1931  
Professor of Economics, Columbia University;  
Director of Research, National Bureau of Economic  
Research. 2 Horatio Street, New York, N. Y.
- Montgomery, James Alan, Ph.D., S.T.D., Litt.D., D.H.L.** 1925  
Philologist, Formerly Director and President, American  
Schools of Oriental Research; Professor Emeritus  
of Hebrew, Graduate School, University of Pennsylvania.  
6806 Greene Street, Germantown, Philadelphia, Pa.
- Moore, George Thomas, A.M., Ph.D.** 1905  
Botanist, Director, Missouri Botanical Garden,  
St. Louis, Mo.

|                                                                                                                                                                                                                                                    | Date of<br>Election |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Moore, J. Percy, Ph.D.</b><br>Professor Emeritus of Zoology, University of<br>Pennsylvania, Philadelphia, Pa.                                                                                                                                   | 1918                |
| <b>Moore, John Bassett, LL.D.</b><br>International Law, Diplomatist, Member, Permanent<br>Court of Arbitration (1912-28); Judge, Permanent<br>Court of International Justice (1921-28).<br>960 Park Avenue, New York, N. Y.                        | 1907                |
| <b>Morey, Charles Rufus, A.M., L.H.D. Litt.D.</b><br>Marquand Professor of Art and Archaeology, Princeton<br>University, Princeton, N. J.                                                                                                          | 1938                |
| <b>Morgan, Marshall S., A.B.</b><br>President, Fidelity-Philadelphia Trust Company.<br>R.F.D. 2, Malvern, Pa.                                                                                                                                      | 1933                |
| <b>Morgan, Thomas Hunt, B.S., Ph.D., D.Sc., LL.D.</b><br>Zoologist, Director, Kerckhoff Laboratories of Biological<br>Sciences, California Institute of Technology,<br>Pasadena, Calif.                                                            | 1915                |
| <b>Morison, Samuel Eliot, Ph.D., M.A., Litt.D.</b><br>Professor of History, Harvard University.<br>Harvard College Library 417, Cambridge, Mass.                                                                                                   | 1937                |
| <b>Morley, Sylvanus Griswold, Ph.D.</b><br>In Charge, Carnegie Institution of Washington<br>Archaeological Expeditions to Central America;<br>Director, Chichen Itza Project.<br>Apartado Postal 385, Merida, Yucatan, Mexico.                     | 1940                |
| <b>Morris, Harrison Smith</b><br>Author, Formerly Managing Director, Pennsylvania<br>Academy of the Fine Arts. Pear Hill, Chelton Avenue<br>and York Road, Philadelphia, Pa.                                                                       | 1899                |
| <b>Morris, Lawrence J., A.B.</b><br>Man of Affairs, Secretary, Pennsylvania Hospital.<br>240 South 4th Street, Philadelphia, Pa.                                                                                                                   | 1936                |
| <b>Morris, Roland S., A.B., LL.B., LL.D., D.C.L., L.H.D.</b><br>Lawyer, Diplomatist, Professor of International Law,<br>University of Pennsylvania; United States Ambassador<br>to Japan (1917-21). 1617 Land Title Building,<br>Philadelphia, Pa. | 1922                |

# LIST OF MEMBERS

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Date of  
Election

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Morse, Marston, Ph.D., Sc.D.</b>                                                                                                                            | 1936 |
| Professor of Mathematics, Institute for Advanced Study,<br>Princeton, N. J.                                                                                    |      |
| <b>Moulton, Forest Ray, A.B., Ph.D., Sc.D., LL.D.</b>                                                                                                          | 1916 |
| Mathematician, Astronomer, Permanent Secretary,<br>American Association for the Advancement of Science,<br>Smithsonian Institution Building, Washington, D. C. |      |
| <b>Moulton, Harold Glenn, Ph.D., LL.D.</b>                                                                                                                     | 1938 |
| Economist, President, The Brookings Institution,<br>722 Jackson Place, N. W., Washington, D. C.                                                                |      |
| <b>Mulliken, Robert Sanderson, B.S., Ph.D., Sc.D.</b>                                                                                                          | 1940 |
| Professor of Physics, University of Chicago,<br>Chicago, Ill.                                                                                                  |      |
| <b>Mumford, Lewis</b>                                                                                                                                          | 1941 |
| Author. Amenia, N. Y.                                                                                                                                          |      |
| <b>Murlin, John Raymond, B.S., A.M., Ph.D., Sc.D.</b>                                                                                                          | 1932 |
| Professor of Physiology, Director, Department<br>of Vital Economics, University of Rochester,<br>260 Crittenden Boulevard, Rochester, N. Y.                    |      |
| <b>von Neumann, John, Ph.D., C.E.</b>                                                                                                                          | 1938 |
| Professor of Mathematics, Institute for Advanced Study.<br>26 Westcott Road, Princeton, N. J.                                                                  |      |
| <b>Nicolson, Marjorie Hope, Ph.D., Litt.D., L.H.D., LL.D.</b>                                                                                                  | 1941 |
| Professor of English, Columbia University,<br>New York, N. Y.                                                                                                  |      |
| <b>Nitze, William Albert, Ph.D., L.H.D.</b>                                                                                                                    | 1936 |
| Professor of Romance Languages and Literatures,<br>University of Chicago, Chicago, Ill.                                                                        |      |
| <b>Nock, Arthur Darby, LL.D.</b>                                                                                                                               | 1941 |
| Frothingham Professor of the History of Religion,<br>Harvard University, Cambridge, Mass.                                                                      |      |
| <b>Norris, George Washington</b>                                                                                                                               | 1937 |
| Banker, Formerly Governor, Philadelphia Federal Reserve<br>Bank. Land Title Building, Philadelphia, Pa.                                                        |      |
| <b>Norris, George William, B.A., M.D.</b>                                                                                                                      | 1922 |
| Physician, Author, Chief, Medical Service "A,"<br>Pennsylvania Hospital. Dimock, Susquehanna County, Pa.                                                       |      |

|                                                                                                                                                                                 | Date of<br>Election |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Northrop, John Howard, M.A., Ph.D., D.Sc., LL.D.</b><br>Biochemist, Rockefeller Institute for Medical<br>Research, Princeton, N. J.                                          | 1938                |
| <b>Novy, Frederick G., Sc.D., M.D., LL.D.</b><br>Dean Emeritus, Medical School, Professor Emeritus of<br>Bacteriology, University of Michigan, Ann Arbor, Mich.                 | 1934                |
| <b>Ogburn, William Fielding, Ph.D., LL.D.</b><br>Sewell L. Avery Distinguished Service Professor of<br>Sociology, University of Chicago.<br>5525 Woodlawn Avenue, Chicago, Ill. | 1940                |
| <b>Olivier, Charles P., M.A., Ph.D.</b><br>Professor of Astronomy, Director, Flower Observatory,<br>University of Pennsylvania, Upper Darby, Pa.                                | 1932                |
| <b>O'Neill, Eugene Gladstone, Litt.D.</b><br>Author, Playwright. Danville, Contra Costa County, Calif.                                                                          | 1935                |
| <b>Osgood, William Fogg, A.M., Ph.D., LL.D.</b><br>Professor Emeritus of Mathematics, Harvard University.<br>10 Dorset Road, Belmont, Mass.                                     | 1915                |
| <b>Osterhout, Winthrop John Vanleuven, A.M., Ph.D., Sc.D.</b><br>Physiologist, Rockefeller Institute for Medical Research,<br>66th Street and York Avenue, New York, N. Y.      | 1917                |
| <b>Packard, Francis Randolph, M.D., LL.D.</b><br>Physician, Author. 304 South 19th Street,<br>Philadelphia, Pa.                                                                 | 1933                |
| <b>Painter, Theophilus Shickel, Ph.D., Sc.D.</b><br>Professor of Zoology, University of Texas.<br>610 West 33rd Street, Austin, Texas.                                          | 1939                |
| <b>Parker, George Howard, Sc.D.</b><br>Professor Emeritus of Zoology, Harvard University.<br>16 Berkeley Street, Cambridge, Mass.                                               | 1911                |
| <b>†Paton, Stewart, M.A., M.D.</b><br>Psychiatrist, Author. New York, N. Y.                                                                                                     | 1914                |
| <b>Patterson, Ernest Minor, A.B., A.M., Ph.D., LL.D.</b><br>Professor of Economics, University of Pennsylvania.<br>404 South 47th Street, Philadelphia, Pa.                     | 1932                |

† Deceased January 7, 1942.

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Patterson, Lamar Gray</b><br>Chemist. Perdido Beach, Ala.                                                                                                                                                                                       | 1898 |
| <b>Pauling, Linus Carl, Ph.D., Sc.D.</b><br>Professor of Chemistry, Chairman, Division of Chemistry<br>and Chemical Engineering, Director, Gates and Crellin<br>Laboratories of Chemistry, California Institute of<br>Technology, Pasadena, Calif. | 1936 |
| <b>Pender, Harold, A.B., Ph.D., Sc.D.</b><br>Dean, Moore School of Electrical Engineering,<br>University of Pennsylvania; Consulting Engineer,<br>Philadelphia, Pa.                                                                                | 1917 |
| <b>Pepper, George Wharton, B.A., LL.B., LL.D., D.C.L.</b><br>Lawyer, United States Senator (1922-27);<br>Formerly Professor of Law, University of Pennsylvania.<br>2231 Land Title Building, Philadelphia, Pa.                                     | 1897 |
| <b>Pepper, William, A.B., M.D., Sc.D.</b><br>Dean, School of Medicine, University of Pennsylvania.<br>Prospect Avenue, Melrose Park, Philadelphia, Pa.                                                                                             | 1937 |
| <b>Perry, Ralph Barton, Ph.D., Litt.D., L.H.D.</b><br>Professor of Philosophy, Harvard University.<br>445 Widener Library, Cambridge, Mass.                                                                                                        | 1939 |
| <b>Phelps, William Lyon, Ph.D., Litt.D., L.H.D., LL.D.,<br/>D.D., D.S.T.</b><br>Author, Professor Emeritus of English Literature,<br>Yale University. 110 Whitney Avenue, New Haven, Conn.                                                         | 1927 |
| <b>Pound, Roscoe, Ph.D., LL.D., J.U.D., L.H.D.</b><br>University Professor at Harvard.<br>304 School Street, Watertown, Mass.                                                                                                                      | 1940 |
| <b>Prince, John Dyneley, B.A., Ph.D.</b><br>Orientalist and Comparative Philologist,<br>Professor Emeritus of East European Languages,<br>Philosophy Hall, Columbia University, New York, N. Y.                                                    | 1913 |
| <b>Putnam, Herbert, Litt.D., LL.D.</b><br>Librarian Emeritus of Congress, Washington, D. C.                                                                                                                                                        | 1937 |
| <b>Quinn, Arthur Hobson, Ph.D., Litt.D.</b><br>John Welch Centennial Professor of History and<br>English Literature, University of Pennsylvania.<br>401 Pembroke Road, Bala-Cynwyd, Pa.                                                            | 1940 |



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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Rabi, Isidor Isaac, Ph.D.</b><br>Professor of Physics, Columbia University.<br>Massachusetts Institute of Technology, Cambridge, Mass.                                                                                                                          | 1941                |
| <b>Rand, Edward Kennard, A.B., A.M., Ph.D., Litt.D., LL.D.</b><br>Pope Professor of Latin, Harvard University.<br>107 Lake View Avenue, Cambridge, Mass.                                                                                                           | 1925                |
| <b>Ravenel, Mazÿck P., M.D.</b><br>Physician, Editor-in-Chief, <i>American Journal of Public Health</i> . University of Missouri, Columbia, Mo.                                                                                                                    | 1901                |
| <b>Read, Conyers, A.M., Ph.D., B.Litt., Litt.D.</b><br>Professor of English History (on leave of absence),<br>University of Pennsylvania. 1520 Locust Street,<br>Philadelphia, Pa.                                                                                 | 1934                |
| <b>Reeves, Jesse S., Ph.D., L.H.D., LL.D.</b><br>Professor of Political Science, University of Michigan.<br>1945 Cambridge Road, Ann Arbor, Mich.                                                                                                                  | 1934                |
| <b>Reid, Harry Fielding, C.E., A.B., Ph.D.</b><br>Professor Emeritus of Dynamical Geology and<br>Geography, Johns Hopkins University, Baltimore, Md.                                                                                                               | 1910                |
| <b>Reisner, George Andrew, Ph.D., D.Litt.</b><br>Professor of Egyptology, Harvard University; Director,<br>Egyptian Expedition of Harvard University and Boston<br>Museum of Fine Arts; Curator, Egyptian Department,<br>Boston Museum of Fine Arts, Boston, Mass. | 1940                |
| <b>Repplier, Agnes, Litt.D.</b><br>Author. 920 Clinton Street, Philadelphia, Pa.                                                                                                                                                                                   | 1928                |
| <b>Rhoads, Charles James, A.B.</b><br>Banker (ret.), Trustee, Bryn Mawr College,<br>Haverford College. Bryn Mawr, Pa.                                                                                                                                              | 1921                |
| <b>Richards, Alfred Newton, Ph.D., Sc.D., M.D., LL.D.</b><br>Professor of Pharmacology, University of Pennsylvania.<br>6 Rugby Road, Bryn Mawr, Pa.                                                                                                                | 1935                |
| <b>Richards, Horace Clark, A.B., Ph.D.</b><br>Professor Emeritus of Mathematical Physics,<br>University of Pennsylvania.<br>509 Woodland Terrace, Philadelphia, Pa.                                                                                                | 1907                |

**Riddle, Oscar, A.B., Ph.D., LL.D.**

Physiologist, Carnegie Institution, Station for  
Experimental Evolution, Cold Spring Harbor,  
Long Island, N. Y.

**Robbins, William Jacob, Ph.D., Sc.D.**

Professor of Botany, Columbia University;  
Director, New York Botanical Garden,  
Bronx Park, New York, N. Y.

**Roberts, Owen J., A.B., LL.B., LL.D., D.C.L.**

Associate Justice, Supreme Court of the United States,  
Washington, D. C.

**Robertson, Howard Percy, Ph.D.**

Professor of Mathematical Physics, Princeton  
University. 175 Prospect Avenue, Princeton, N. J.

**Robinson, David Moore, Ph.D., LL.D., L.H.D., Litt.D.**

Professor of Archaeology and Epigraphy, Lecturer in  
Greek Literature, Johns Hopkins University,  
Baltimore, Md.

**Rockefeller, John D., Jr., A.B., A.M.**

Administrator, Trustee, Rockefeller Institute for Medical  
Research. 30 Rockefeller Plaza, New York, N. Y.

**Rogers, Lindsay, Ph.D., LL.B.**

Burgess Professor of Public Law, Columbia University.  
175 Riverside Drive, New York, N. Y.

**Rolfe, John Carew, Ph.D., Litt.D.**

Professor Emeritus of Latin, University of Pennsylvania.  
The Fairfax, 43rd and Locust Streets, Philadelphia, Pa.

**Rosenbach, A. S. W., B.S., Ph.D., D.F.A.**

Author, Bibliographer, President, Gratz College.  
1320 Walnut Street, Philadelphia, Pa.

**Rosengarten, Adolph G., B.S.**

Man of Affairs, Trustee, University of Pennsylvania,  
Lankenau Hospital. St. Davids, Pa.

**Rostovtzeff, Michael I., Ph.D., LL.D.**

Director of Archaeological Research, Yale University.  
470 Whitney Avenue, New Haven, Conn.

|                                                                                                                                                                                                             | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Rous, Peyton, M.D., D.Sc.</b><br>Member, Rockefeller Institute for Medical Research.<br>125 East 72nd Street, New York, N. Y.                                                                            | 1939                |
| <b>Rowe, Leo S., Ph.B., LL.B., Ph.D., LL.D.</b><br>Director General, Pan-American Union,<br>Washington, D. C.                                                                                               | 1911                |
| <b>Russell, Henry Norris, A.M., Ph.D., D.Sc.</b><br>Professor of Astronomy, Director, Princeton University<br>Observatory. 79 Alexander Street, Princeton, N. J.                                            | 1913                |
| <b>Ruthven, Alexander G., B.S., Ph.D., LL.D., Sc.D.</b><br>Zoologist, President, University of Michigan,<br>Ann Arbor, Mich.                                                                                | 1931                |
| <b>Sanders, Henry A., A.B., A.M., Ph.D., L.H.D.</b><br>Professor Emeritus of Latin, University of Michigan.<br>2037 Geddes Avenue, Ann Arbor, Mich.                                                         | 1932                |
| <b>Sarton, George, D.Sc., L.H.D., LL.D.</b><br>Historian of Science, Editor of <i>Isis</i> .<br>Harvard Library 185, Cambridge, Mass.                                                                       | 1934                |
| <b>Scattergood, J. Henry, A.B.</b><br>Man of Affairs, Treasurer, Haverford College,<br>Bryn Mawr College. Villa Nova, Pa.                                                                                   | 1931                |
| <b>Schaeffer, J. Parsons, A.M., M.D., Ph.D., Sc.D.</b><br>Professor of General Anatomy, Director, Daniel Baugh<br>Institute of Anatomy, Jefferson Medical College.<br>4634 Spruce Street, Philadelphia, Pa. | 1927                |
| <b>Schelling, Felix E., Ph.D., Litt.D., LL.D.</b><br>Professor Emeritus of English Literature,<br>University of Pennsylvania. 251 Claremont Avenue,<br>Mount Vernon, N. Y.                                  | 1902                |
| <b>Schlesinger, Arthur Meier, Ph.D., Litt.D.</b><br>Francis Lee Higginson Professor of History,<br>Harvard University. 19 Gray Gardens East,<br>Cambridge, Mass.                                            | 1941                |
| <b>Schlesinger, Frank, B.S., M.A., Ph.D., Sc.D.</b><br>Director Emeritus, Yale University Observatory.<br>Lyme, Conn.                                                                                       | 1912                |

# LIST OF MEMBERS

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Date of  
Election

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Schramm, Jacob Richard, A.B., Ph.D.</b><br>Professor of Botany, Director, Department of<br>Botany, Director, Morris Arboretum,<br>University of Pennsylvania, Philadelphia, Pa.                                                                                             | 1932 |
| <b>Schuchert, Charles, M.A., LL.D., Sc.D.</b><br>Professor Emeritus of Paleontology, Peabody Museum,<br>Yale University, New Haven, Conn.                                                                                                                                      | 1913 |
| <b>Schultz, Adolph H., Ph.D.</b><br>Associate Professor of Physical Anthropology, School of<br>Medicine, Johns Hopkins University, Baltimore, Md.                                                                                                                              | 1936 |
| <b>Schurman, Jacob Gould, A.B., A.M., Sc.D., Ph.D., LL.D.</b><br>Administrator, Diplomatist, President, Cornell<br>University (1892-1920); United States Minister to<br>China (1921-25); United States Ambassador to<br>Germany (1925-30). 1 West 54th Street, New York, N. Y. | 1908 |
| <b>Scott, James Brown, A.B., A.M., J.U.D., LL.D.</b><br>Secretary Emeritus, Carnegie Endowment for<br>International Peace. Wardour, Annapolis, Md.                                                                                                                             | 1930 |
| <b>Scott, John Morin, A.B.</b><br>Lawyer. 1903 Spruce Street, Philadelphia, Pa.                                                                                                                                                                                                | 1926 |
| <b>Scott, William Berryman, M.A., Ph.D., Sc.D., LL.D.</b><br>Blair Professor Emeritus of Geology,<br>Princeton University. 7 Cleveland Lane, Princeton, N. J.                                                                                                                  | 1886 |
| <b>Seares, Frederick Hanley, B.S., LL.D.</b><br>Astronomer, Assistant Director, Mount Wilson<br>Observatory, Pasadena, Calif.                                                                                                                                                  | 1917 |
| <b>See, Thomas Jefferson Jackson, A.M., Lt.M., Sc.M., Ph.D.,<br/>D.Sc.</b><br>Physicist, Astronomer, Geometer, Professor of<br>Mathematics, United States Navy (ret.).<br>614 Ohio Street, Vallejo, Calif.                                                                     | 1897 |
| <b>Setchell, William Albert, A.M., Ph.D.</b><br>Professor Emeritus of Botany, University of<br>California, Berkeley, Calif.                                                                                                                                                    | 1919 |
| <b>Seymour, Charles, Ph.D., Litt.D., LL.D., L.H.D.</b><br>President, Yale University.<br>43 Hillhouse Avenue, New Haven, Conn.                                                                                                                                                 | 1939 |

|                                                                                                                                                                                                                                                 | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Shapley, Harlow, A.M., Ph.D., LL.D., Sc.D.</b><br>Astronomer, Director, Harvard College Observatory,<br>Cambridge, Mass.                                                                                                                     | 1922                |
| <b>Shear, Theodore Leslie, Ph.D., L.H.D.</b><br>Professor of Classical Archaeology,<br>Princeton University, Princeton, N. J.                                                                                                                   | 1939                |
| <b>Shotwell, James Thomson, Ph.D., LL.D.</b><br>Professor of History, Columbia University; Trustee and<br>Director, Division of Economics and History, Carnegie<br>Endowment for International Peace.<br>405 West 117th Street, New York, N. Y. | 1936                |
| <b>Shull, George Harrison, B.S., Ph.D., Sc.D., LL.D.</b><br>Professor of Botany and Genetics, Princeton University.<br>60 Jefferson Road, Princeton, N. J.                                                                                      | 1918                |
| <b>Simpson, George Gaylord, Ph.D.</b><br>Associate Curator of Vertebrate Paleontology,<br>American Museum of Natural History, New York, N. Y.                                                                                                   | 1936                |
| <b>Singer, Edgar Arthur, Jr., B.S., Ph.D.</b><br>Professor of Philosophy, University of Pennsylvania.<br>4224 Chester Avenue, Philadelphia, Pa.                                                                                                 | 1925                |
| <b>Sinnott, Edmund Ware, Ph.D.</b><br>Sterling Professor of Botany, Yale University,<br>New Haven, Conn.                                                                                                                                        | 1939                |
| <b>Sioussat, St. George Leakin, Ph.D.</b><br>Chief, Division of Manuscripts, Incumbent, Chair of<br>American History, Library of Congress,<br>Washington, D. C.                                                                                 | 1928                |
| <b>Slater, John Clarke, Ph.D.</b><br>Professor of Physics, Massachusetts Institute of<br>Technology, Cambridge, Mass.                                                                                                                           | 1940                |
| <b>Slipher, Vesto Melvin, A.M., Ph.D., LL.D., Sc.D.</b><br>Astronomer, Director, Lowell Observatory,<br>Flagstaff, Ariz.                                                                                                                        | 1921                |
| <b>Smyth, Charles Phelps, Ph.D.</b><br>Professor of Chemistry, Princeton University.<br>22 Morven Street, Princeton, N. J.                                                                                                                      | 1932                |

# LIST OF MEMBERS

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Date of  
Election

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Speiser, Ephraim Avigdor, M.A., Ph.D.</b><br>Professor of Semitics, University of Pennsylvania.<br>10 English Village, Wynnewood, Pa                                                                                                                    | 1941 |
| <b>Spoehr, Herman Augustus, Ph.D., Sc.D.</b><br>Chairman, Division of Plant Biology, Carnegie Institution<br>of Washington, Stanford University, Calif.                                                                                                    | 1931 |
| <b>Sprague, Oliver Mitchell Wentworth, A.M., Ph.D., Litt.D.</b><br>Edmund Cogswell Converse Professor of Banking and<br>Finance, Harvard Graduate School of Business,<br>Soldier's Field, Boston, Mass.                                                    | 1938 |
| <b>Stadler, Lewis John, Ph.D.</b><br>Professor of Field Crops, University of Missouri;<br>Principal Geneticist, Bureau of Plant Industry,<br>United States Department of Agriculture.<br>308 Thilly Avenue, Columbia, Mo.                                  | 1941 |
| <b>Stakman, Elvin Charles, Ph.D., Dr.Nat.Science</b><br>Professor and Chief, Division of Plant Pathology and<br>Botany, University of Minnesota Experiment Station;<br>Agent, United States Department of Agriculture.<br>University Farm, St. Paul, Minn. | 1940 |
| <b>Stanley, Wendell Meredith, Ph.D., Sc.D.</b><br>Biochemist, Member, Rockefeller Institute<br>for Medical Research, Princeton, N. J.                                                                                                                      | 1940 |
| <b>Stebbins, Joel, Ph.D., Sc.D., LL.D.</b><br>Professor of Astronomy, Director, Washburn Observatory,<br>University of Wisconsin, Madison, Wis.                                                                                                            | 1925 |
| <b>Stefansson, Vilhjalmur, Ph.D., LL.D.</b><br>Arctic Explorer, Geographer and Adviser on Northern<br>Operations to Pan-American Airways.<br>67 Morton Street, New York, N. Y.                                                                             | 1923 |
| <b>Stone, Harlan Fiske, LL.B., LL.D.</b><br>Chief Justice, Supreme Court of the United<br>States. 2340 Wyoming Avenue, Washington, D. C.                                                                                                                   | 1939 |
| <b>Struve, Otto, Ph.D., Sc.D.</b><br>Professor of Astrophysics, University of Chicago;<br>Director, Yerkes Observatory, Williams Bay, Wis.                                                                                                                 | 1937 |

|                                                                                                                                                                                                                                                                                 | Date of<br>Election |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Sturtevant, Alfred Henry, Ph.D.</b><br>Professor of Genetics, California Institute of Technology,<br>Pasadena, Calif.                                                                                                                                                        | 1936                |
| <b>Sturtevant, Edgar Howard, Ph.D., L.H.D., LL.D.</b><br>Professor of Linguistics, Yale University.<br>408 Whitney Avenue, New Haven, Conn.                                                                                                                                     | 1939                |
| <b>Sumner, Francis Bertody, Ph.D.</b><br>Professor of Biology, Scripps Institution of Oceanography,<br>University of California, La Jolla, Calif.                                                                                                                               | 1938                |
| <b>Swann, William Francis Gray, M.A., D.Sc.</b><br>Physicist, Director, Bartol Research Foundation,<br>Whittier Place, Swarthmore, Pa.                                                                                                                                          | 1926                |
| <b>Taliaferro, William Hay, Ph.D.</b><br>Eliakim H. Moore Distinguished Service Professor of<br>Parasitology, Chairman, Department of Bacteriology<br>and Parasitology, Dean, Division of Biological Sciences,<br>University of Chicago. 950 East 59th Street,<br>Chicago, Ill. | 1941                |
| <b>Tate, John Torrence, Ph.D., D.Sc.</b><br>Professor of Physics, Dean, College of Science,<br>Literature and the Arts, University of Minnesota.<br>1943 East River Road, Minneapolis, Minn.                                                                                    | 1941                |
| <b>Tatlock, J. S. P., Ph.D., Litt.D., LL.D.</b><br>Professor of English, University of California.<br>1994 San Antonio Street, Berkeley, Calif.                                                                                                                                 | 1937                |
| <b>Taylor, Deems, A.B., Mus.D., Litt.D.</b><br>Musician, Composer, Writer. The Haviland Road,<br>Stamford, Conn.                                                                                                                                                                | 1934                |
| <b>Taylor, Hugh Stott, D.Sc., LL.D.</b><br>David B. Jones Professor of Chemistry,<br>Princeton University, Princeton, N. J.                                                                                                                                                     | 1928                |
| <b>Thorndike, Edward L., A.B., A.M., Ph.D., Sc.D., LL.D.</b><br>Professor Emeritus of Educational Psychology, Teachers<br>College, Columbia University, New York, N. Y.                                                                                                         | 1930                |
| <b>Thorndike, Lynn, Ph.D., L.H.D.</b><br>Professor of History, Columbia University,<br>New York, N. Y.                                                                                                                                                                          | 1939                |

## LIST OF MEMBERS

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Date of  
Election

- Timoshenko, Stephen P., D.Sc.** 1939  
Professor of Theoretical and Applied Mechanics,  
Stanford University. 536 West Crescent Drive,  
Palo Alto, Calif.
- Tolman, Richard Chace, Ph.D.** 1932  
Professor of Physical Chemistry and Mathematical  
Physics, California Institute of Technology,  
Pasadena, Calif.
- Tozzer, Alfred Marston, A.B., A.M., Ph.D.** 1937  
Professor of Anthropology, Harvard University.  
7 Bryant Street, Cambridge, Mass.
- Trelease, William, Sc.D., LL.D.** 1903  
Professor Emeritus of Botany, University of Illinois,  
Urbana, Ill.
- Tucker, Richard Hawley, C.E., Sc.D.** 1908  
Astronomer, Formerly of Lick Observatory.  
1525 Waverly Street, Palo Alto, Calif.
- Tyzzer, Ernest Edward, Ph.B., A.M., M.D., Sc.D.** 1931  
Professor of Comparative Pathology and Tropical  
Medicine, Harvard Medical School.  
175 Water Street, Wakefield, Mass.
- Urey, Harold Clayton, Ph.D., D.Sc., N.L.** 1935  
Professor of Chemistry, Executive Officer of the  
Department, Columbia University.  
355 Highwood Avenue, Leonia, N. J.
- Van Vleck, John Hasbrouck, Ph.D.** 1939  
Professor of Mathematical Physics,  
Harvard University, Cambridge, Mass.
- Van Slyke, Donald Dexter, Ph.D., Sc.D., M.D.** 1938  
Biochemist, Rockefeller Institute for Medical Research,  
66th Street and York Avenue, New York, N. Y.
- Vaughan, Thomas Wayland, B.Sci., A.M., Ph.D., LL.D.** 1923  
Director Emeritus, Scripps Institution of Oceanography;  
Principal Scientist (ret.), United States Geological  
Survey; Associate, United States National Museum.  
3333 P Street, Washington, D. C.



|                                                                                                                                                                                                 | Date of<br>Election |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Veblen, Oswald, A.B., Ph.D., D.Sc.</b><br>Professor of Mathematics, Institute for Advanced Study.<br>58 Battle Road, Princeton, N. J.                                                        | 1912                |
| <b>Warren, Charles, A.B., A.M., LL.D.</b><br>Lawyer. 1527 Eighteenth Street, Washington, D. C.                                                                                                  | 1939                |
| <b>Warren, Charles Hyde, Ph.B., Ph.D.</b><br>Dean, Sheffield Scientific School, Professor of Geology,<br>Yale University. 100 High Street, New Haven, Conn.                                     | 1928                |
| <b>Webster, David Locke, A.B., Ph.D.</b><br>Professor and Executive Head, Department of Physics,<br>Stanford University, Calif.                                                                 | 1922                |
| <b>Wertenbaker, Thomas Jefferson, Ph.D., L.H.D., Litt.D.</b><br>Edwards Professor of American History,<br>Princeton University. 164 Prospect Avenue,<br>Princeton, N. J.                        | 1941                |
| <b>Wetherill, Samuel Price, B.S., LL.D.</b><br>Engineer. 1203 Morris Building, Philadelphia, Pa.                                                                                                | 1933                |
| <b>Wetmore, Alexander, A.B., M.S., Ph.D., D.Sc.</b><br>Zoologist, Assistant Secretary, Smithsonian Institution;<br>In Charge, United States National Museum,<br>Washington, D. C.               | 1930                |
| <b>Weyl, Hermann, Ph.D., D.Eng., D.Sc.</b><br>Professor of Mathematics, Institute for Advanced Study.<br>Fine Hall, Princeton, N. J.                                                            | 1935                |
| <b>Whipple, George Hoyt, M.D., M.A., D.Sc., LL.D.</b><br>Professor of Pathology, Dean, School of Medicine<br>and Dentistry, University of Rochester.<br>320 Westminister Road, Rochester, N. Y. | 1938                |
| <b>Whitney, Willis R., S.B., Ph.D., Sc.D., Ch.D., LL.D.</b><br>Chemist, Honorary Vice-president,<br>General Electric Company, Schenectady, N. Y.                                                | 1931                |
| <b>Willis, Bailey, E.M., C.E., Ph.D.</b><br>Professor Emeritus of Geology, Stanford University.<br>Box 1365, Stanford University, Calif.                                                        | 1905                |
| <b>Willits, Joseph Henry, A.M., Ph.D., LL.D.</b><br>Director for the Social Sciences, Rockefeller Foundation,<br>49 West 49th Street, New York, N. Y.                                           | 1938                |

# LIST OF MEMBERS

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Date of  
Election

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Wilson, Edwin Bidwell, A.B., Ph.D.</b><br>Professor of Vital Statistics, Harvard School of Public<br>Health. 55 Shattuck Street, Boston, Mass.                                    | 1917 |
| <b>Wilson, George Grafton, Ph.D., LL.D.</b><br>Professor Emeritus of International Law,<br>Langdell Hall, Harvard University, Cambridge, Mass.                                       | 1936 |
| <b>Wilson, Harold Albert, M.A., M.Sc., D.Sc.</b><br>Professor of Physics, The Rice Institute, Houston, Texas                                                                         | 1914 |
| <b>Winlock, Herbert Eustis, Art.D., Litt.D.</b><br>Director Emeritus and Formerly Curator,<br>Egyptian Department, Metropolitan Museum of Art.<br>1010 Fifth Avenue, New York, N. Y. | 1939 |
| <b>Wissler, Clark, A.M., Ph.D., LL.D.</b><br>Curator of Anthropology, American Museum of<br>Natural History, New York, N. Y.                                                         | 1924 |
| <b>Witmer, Lightner, A.M., Ph.D.</b><br>Professor Emeritus of Psychology, University of<br>Pennsylvania. Box 186, Devon, Pa.                                                         | 1897 |
| <b>Wolman, Leo, Ph.D.</b><br>Professor of Economics, Columbia University.<br>National Bureau of Economic Research,<br>1819 Broadway, New York, N. Y.                                 | 1941 |
| <b>Woodworth, Robert Sessions, A.B., A.M., Ph.D., Sc.D.,<br/>LL.D.</b><br>Professor of Psychology, Columbia University,<br>New York, N. Y.                                           | 1936 |
| <b>Wright, Frederick E., Ph.D.</b><br>Petrologist, Geophysical Laboratory, Carnegie Institution<br>of Washington. 2134 Wyoming Avenue, Washington, D. C.                             | 1914 |
| <b>Wright, Sewall, B.S., M.S., Sc.D.</b><br>Ernest D. Burton Distinguished Service<br>Professor of Zoology, University of Chicago.<br>5762 Harper Avenue, Chicago, Ill.              | 1932 |
| <b>Wright, William Hammond, D.Sc.</b><br>Astronomer, Director, Lick Observatory,<br>Mount Hamilton, Calif.                                                                           | 1935 |

|                                                                                                                                                                                            | Date of<br>Election |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Yeatman, Pope, E.M., D.E.</b><br>Mining Engineer. 165 Broadway, New York, N. Y.                                                                                                         | 1920                |
| <b>Yerkes, Robert Mearns, Ph.D., D.Sc., LL.D.</b><br>Director, Yale Laboratories of Primate Biology;<br>Professor of Psychobiology, Yale University,<br>333 Cedar Street, New Haven, Conn. | 1936                |
| <b>Young, James Thomas, Ph.D.</b><br>Political Scientist, Professor of Public Administration,<br>University of Pennsylvania, Philadelphia, Pa.                                             | 1933                |
| <b>Young, Owen D., A.B., D.H.L., LL.B., Litt.D., D.C.S.</b><br>Lawyer, Honorary Chairman, General Electric Company.<br>570 Lexington Avenue, New York, N. Y.                               | 1929                |
| <b>Zeleny, John, M.A., Ph.D.</b><br>Professor of Physics, Yale University.<br>44 Cold Spring Street, New Haven, Conn.                                                                      | 1915                |

Total Resident Members—451.

December 31, 1941.

## FOREIGN MEMBERS

|                                                                                                                                                                                                                  | Date of<br>Election |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Adams, Frank Dawson, Ph.D., D.Sc., LL.D., F.R.S.</b><br>Geologist, Vice-principal Emeritus, McGill University,<br>Montreal, Canada.                                                                           | 1916                |
| <b>Adrian, Edgar Douglas, M.A., M.D., Sc.D., LL.D., F.R.S.</b><br>Professor of Physiology, Cambridge University.<br>St. Chad's, Grange Road, Cambridge, England.                                                 | 1938                |
| <b>Bell, Harold Idris, D.Litt., F.B.A., F.S.A.</b><br>Keeper of the Manuscripts and Egerton Librarian,<br>British Museum, London, W.C.1, England.                                                                | 1941                |
| <b>Beneš, Eduard, Ph.D., LL.D.</b><br>Formerly President, Czechoslovak Republic.                                                                                                                                 | 1939                |
| <b>Bohr, Niels Henrik David, Dr.phil.</b><br>Professor of Theoretical Physics, University of<br>Copenhagen; Director, Institute of Theoretical Physics.<br>G. 1 Carlsberg, Copenhagen, Denmark.                  | 1940                |
| <b>†Bragg, Sir William Henry, D.Sc.</b><br>Fullerian Professor of Chemistry, Royal Institution;<br>Director, Davy-Faraday Research Laboratory.<br>Royal Institution, Albemarle Street, W. 1,<br>London, England. | 1940                |
| <b>de Broglie, Prince Louis Victor, D.Sc.</b><br>Professor of Theoretical Physics, University of Paris.<br>94 Rue Perronet, Neuilly-sur-Seine, France.                                                           | 1939                |
| <b>Cumont, Franz Valery Marie, D.Litt.</b><br>Authority on Religions of the Roman Empire.<br>19 Corso d'Italia, Rome, Italy.                                                                                     | 1940                |
| <b>Dale, Sir Henry Hallett, M.D., D.Sc., LL.D., F.R.S.</b><br>Director, National Institute for Medical Research.<br>Mt. Vernon House, Hampstead, London, N.W.3, England.                                         | 1939                |
| <b>Debye, Peter</b><br>Chairman of the Department of Chemistry and Professor<br>of Chemistry, Cornell University, Ithaca, N. Y.                                                                                  | 1936                |

† Deceased March 12, 1942.

|                                                                                                                                                                                                                           | Date of<br>Election |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Dirac, Paul Adrien Maurice, Ph.D., F.R.S.</b><br>Lucasian Professor of Mathematics, Cambridge University.<br>St. John's College, Cambridge, England.                                                                   | 1938                |
| <b>Eddington, Sir Arthur Stanley, M.A., B.Sc., D.Sc., LL.D.,<br/>F.R.S.</b><br>Astronomer, Director, The Observatory,<br>Cambridge, England.                                                                              | 1931                |
| <b>Fisher, Ronald Aylmer, Sc.D., LL.D., F.R.S.</b><br>Galton Professor of Eugenics, University College, London.<br>The Galton Laboratory, Rothamsted Experimental Station,<br>Harpenden, Hertfordshire, England.          | 1941                |
| <b>Gooch, George Peabody, D.Litt.</b><br>Honorary Fellow, Trinity College, Cambridge University.<br>76 Campden Hill Road, London, W.8, England.                                                                           | 1939                |
| <b>Hardy, Godfrey Harold, D.Sc., LL.D., D.Phil.</b><br>Sadleirian Professor of Pure Mathematics, University of<br>Cambridge; Fellow, Trinity College, Cambridge, England.                                                 | 1939                |
| <b>Heckscher, Eli Filip, Ph.D., D.Sc.</b><br>Research Professor of Economic History, University of<br>Stockholm. Baldersgatan 10 a, Stockholm, Sweden.                                                                    | 1940                |
| <b>Heisenberg, Werner, Ph.D.</b><br>Professor of Theoretical Physics, University of Leipzig.<br>Bozenerweg 14, Leipzig, Germany.                                                                                          | 1937                |
| <b>Hertzsprung, Ejnar</b><br>Director, Leiden Observatory, Leiden, Netherlands.                                                                                                                                           | 1941                |
| <b>Hilbert, David</b><br>Professor of Mathematics, University of Göttingen.<br>Wilhelm-Weber-Strasse, Göttingen, Germany.                                                                                                 | 1932                |
| <b>Hill, Archibald Vivian, Sc.D., LL.D., M.D.</b><br>Physiologist, Foulerton Research Professor and Secretary<br>of the Royal Society. University of London, University<br>College, Gower Street, London, W.C.1, England. | 1938                |
| <b>Hjort, Johan, Ph.D., Sc.D.</b><br>Professor of Marine Biology, Oslo University,<br>Oslo, Norway.                                                                                                                       | 1939                |

- Hopkins, Sir Frederick Gowland, M.A., M.B., D.Sc., LL.D., D.C.L., F.R.S.** 1937  
 Physiologist, Professor of Biochemistry, University of Cambridge. Saxmeadham, Grange Road, Cambridge, England.
- Hu Shih, A.B., Ph.D., LL.D., Litt.D., L.H.D., D.C.L.** 1936  
 Philosopher, Professor and Dean, College of Letters, National University of Peking, Peiping; Chinese Ambassador to United States. Chinese Embassy, Washington, D. C.
- Irvine, Sir James Colquhoun, C.B.E., Ph.D., Sc.D., LL.D., D.C.L., F.R.S.** 1933  
 Chemist, Principal and Vice-chancellor, University of St. Andrews, Fifeshire, Scotland.
- Janet, Pierre, Dr. ès lettres, Dr. en médecine, Sc.D.** 1940  
 Professor of Psychology, Collège de France; Director, Laboratoire de Psychologie pathologique, Clinique de la Salpêtrière. Rue de Varenne 54, Paris VII, France.
- Keith, Sir Arthur, Kt., F.R.S., M.D., D.Sc., F.R.C.S., LL.D.** 1931  
 Anthropologist, Master, Buckston Browne Research Farm, Downe, Farnborough, Kent, England.
- Keith, Arthur Berriedale, D.C.L., D.Litt., LL.D.** 1935  
 Barrister at Law, Advocate and Orientalist, Regius Professor of Sanskrit and Comparative Philology, Lecturer on the Constitution of the British Empire, University of Edinburgh, Edinburgh, Scotland.
- Kenyon, Sir Frederic George, M.A., D.Litt., LL.D., L.H.D., Ph.D.** 1937  
 Archaeologist and Philologist, Secretary, British Academy; Formerly President, London Society of Antiquaries; Formerly Director, British Museum. Kirkstead, Godstone, Surrey, England.
- Krogh, August, Ph.D., LL.D., M.D., Sc.D.** 1941  
 Professor of Zoophysiology, Copenhagen University, Copenhagen, Denmark.
- Larmor, Sir Joseph, Kt., M.A., Sc.D., LL.D., D.C.L., F.R.S.** 1913  
 Physicist, Professor Emeritus of Mathematics, Cambridge University; Fellow, St. John's College. Holywood, Northern Ireland.

|      |                                                                                                                                                                                                                                                                                            |                             |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1932 | de Margerie, Emmanuel<br>Geologist, Formerly President, Geological Society<br>of France. 110 Rue du Bac, Paris VII, France.                                                                                                                                                                | Date of<br>Election<br>1932 |
| 1939 | Nilsson, Martin P., Ph.D.<br>Professor of Classical Archaeology and Ancient History,<br>University of Lund. Bredgatan 25, Lund, Sweden.                                                                                                                                                    | 1939                        |
| 1908 | Penck, Albrecht F. K., Ph.D., Sc.D.<br>Professor Emeritus of Geography, University of Berlin.<br>Meierottostrasse 511, Berlin W15, Germany.                                                                                                                                                | 1908                        |
| 1905 | Petrie (William Matthew), Sir Flinders, Kt., D.C.L.,<br>Litt.D., LL.D., Ph.D., F.R.S., F.S.A.<br>Professor Emeritus of Egyptology, University College,<br>London; Founder, British School of Egyptian Archaeology.<br>Care American Schools of Oriental Research,<br>Jerusalem, Palestine. | 1905                        |
| 1940 | Pidal, Ramón Menéndez, Dr. honoris causa<br>Professor of Romance Philology, University of Madrid,<br>Madrid, Spain.                                                                                                                                                                        | 1940                        |
| 1933 | Planck, Max, Ph.D., M.D., D.Sc.<br>Professor of Physics, University of Berlin,<br>Berlin, Germany.                                                                                                                                                                                         | 1933                        |
| 1917 | Prain, Sir David, Kt., M.A., M.B., LL.D., F.R.S.<br>Botanist, Formerly Trustee, British Museum and Director,<br>Royal Botanic Gardens, Kew. The Well Farm,<br>Whyteleafe, Surrey, England.                                                                                                 | 1917                        |
| 1941 | Rappard, William E., Dr.jur., Litt.D., LL.D.<br>Professor of Public Finance and Political Science,<br>University of Geneva; Director, Graduate Institute of<br>International Studies, Geneva, Switzerland.                                                                                 | 1941                        |
| 1910 | Richardson, Sir Owen Willans, Kt., M.A., D.Sc., LL.D.,<br>F.R.S.<br>Physicist, Yarrow Research Professor of the Royal<br>Society; Director of Research in Physics, Kings College,<br>London. Chandos Lodge, Alton, Hants, England.                                                         | 1910                        |
| 1938 | Rist, Charles, LL.D.<br>Professor of Political Economy, University of Paris.<br>18 bis, Rue du Parc de Clagny, Versailles, France.                                                                                                                                                         | 1938                        |

# LIST OF MEMBERS

335

Date of  
Election

- |                                                                                                                                                                                                     |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Stein, Sir Aurel, F.B.A., Ph.D., D.Litt., D. Sc., D.O.L.</b><br>Archaeologist and Geographer. Srinagar, Kashmir.                                                                                 | 1939 |
| <b>Svedberg, Theodor, Ph.D.</b><br>Professor of Physical Chemistry, Upsala University,<br>Upsala, Sweden.                                                                                           | 1941 |
| <b>Thompson, Sir D'Arcy Wentworth, D.Litt., D.Sc., LL.D.</b><br>Professor of Natural History, St. Andrews University,<br>St. Andrews, Scotland.                                                     | 1941 |
| <b>Toynbee, Arnold Joseph, D. Litt.</b><br>Director of Studies, Royal Institute of International<br>Affairs; Research Professor of International History,<br>University of London, London, England. | 1941 |
| <b>Wilkins, Sir Hubert, Kt., M.C., F.R.G.S., M.B.O.U.</b><br>Geographer. 37 West 53rd Street, New York, N. Y.                                                                                       | 1930 |

Total Foreign Members—45.

December 31, 1941.



## CLASSIFIED LIST OF MEMBERS

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### CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

#### *Mathematics*

|                                  |                                 |
|----------------------------------|---------------------------------|
| Alexander, James W.....          | Princeton, N. J.                |
| Bateman, Harry.....              | Pasadena, Calif.                |
| Bell, Eric Temple.....           | Pasadena, Calif.                |
| Birkhoff, George David.....      | Cambridge, Mass.                |
| Bliss, Gilbert Ames.....         | Chicago, Ill.                   |
| Coble, Arthur Byron.....         | Urbana, Ill.                    |
| Dirac, Paul Adrien Maurice.....  | Cambridge, England              |
| Dresden, Arnold.....             | Swarthmore, Pa.                 |
| Eisenhart, Luther Pfahler.....   | Princeton, N. J.                |
| Evans, Griffith Conrad.....      | Berkeley, Calif.                |
| Fisher, Ronald Aylmer.....       | Harpندن, Hertfordshire, England |
| Hardy, Godfrey Harold.....       | Cambridge, England              |
| Henderson, Robert.....           | Crown Point, N. Y.              |
| Hilbert, David.....              | Göttingen, Germany              |
| Huntington, Edward Vermilye..... | Cambridge, Mass.                |
| Kline, John Robert.....          | Swarthmore, Pa.                 |
| Lefschetz, Solomon.....          | Princeton, N. J.                |
| Lovett, Edgar Odell.....         | Houston, Texas                  |
| Mitchell, Howard Hawks.....      | Merion, Pa.                     |
| Morse, Marston.....              | Princeton, N. J.                |
| von Neumann, John.....           | Princeton, N. J.                |
| Osgood, William Fogg.....        | Belmont, Mass.                  |
| Veblen, Oswald.....              | Princeton, N. J.                |
| Weyl, Hermann.....               | Princeton, N. J.                |

#### *Astronomy*

|                             |                   |
|-----------------------------|-------------------|
| Abbot, Charles Greeley..... | Washington, D. C. |
| Adams, Walter Sydney.....   | Pasadena, Calif.  |
| Aitken, Robert Grant.....   | Berkeley, Calif.  |
| †Curtis, Heber Doust.....   | Ann Arbor, Mich.  |

† Deceased.

|                                |                      |
|--------------------------------|----------------------|
| Douglass, Andrew Ellicott..... | Tucson, Ariz.        |
| Eddington, Arthur Stanley..... | Cambridge, England   |
| Gaposchkin, Cecilia Payne..... | Cambridge, Mass.     |
| Hertzsprung, Ejnar.....        | Leiden, Netherlands  |
| Hubble, Edwin P.....           | Pasadena, Calif.     |
| Lampland, Carl O.....          | Flagstaff, Ariz.     |
| Leuschner, Armin Otto.....     | Berkeley, Calif.     |
| Merrill, Paul Willard.....     | Pasadena, Calif.     |
| Miller, John Anthony.....      | Wallingford, Pa.     |
| Mitchell, Samuel Alfred.....   | University, Va.      |
| Moulton, Forest Ray.....       | Washington, D. C.    |
| Olivier, Charles P.....        | Upper Darby, Pa.     |
| Russell, Henry Norris.....     | Princeton, N. J.     |
| Schlesinger, Frank.....        | Lyme, Conn.          |
| Seares, Frederick Hanley.....  | Pasadena, Calif.     |
| Shapley, Harlow.....           | Cambridge, Mass.     |
| Slipher, Vesto Melvin.....     | Flagstaff, Ariz.     |
| Stebbins, Joel.....            | Madison, Wis.        |
| Struve, Otto.....              | Williams Bay, Wis.   |
| Tucker, Richard Hawley.....    | Palo Alto, Calif.    |
| Wright, William Hammond.....   | Mt. Hamilton, Calif. |

### *Physics*

|                               |                           |
|-------------------------------|---------------------------|
| Adams, Edwin Plimpton.....    | Princeton, N. J.          |
| Anderson, Carl David.....     | Pasadena, Calif.          |
| Beams, Jesse Wakefield.....   | University, Va.           |
| Bohr, Niels Henrik David..... | Copenhagen, Denmark       |
| Bowen, Ira Sprague.....       | Pasadena, Calif.          |
| Bridgman, Percy Williams..... | Cambridge, Mass.          |
| Briggs, Lyman J.....          | Washington, D. C.         |
| de Broglie, Louis Victor..... | Neuilly-sur-Seine, France |
| Compton, Arthur Holly.....    | Chicago, Ill.             |
| Compton, Karl Taylor.....     | Cambridge, Mass.          |
| Coolidge, William David.....  | Schenectady, N. Y.        |
| Crew, Henry.....              | Evanston, Ill.            |
| Darrow, Karl Kelchner.....    | New York, N. Y.           |
| Davissou, Clinton J.....      | New York, N. Y.           |
| Debye, Peter.....             | Ithaca, N. Y.             |
| Dempster, Arthur Jeffrey..... | Chicago, Ill.             |
| Einstein, Albert.....         | Princeton, N. J.          |
| Fermi, Enrico.....            | New York, N. Y.           |
| Foote, Paul Darwin.....       | Pittsburgh, Pa.           |
| Franck, James.....            | Chicago, Ill.             |

|                                    |                             |
|------------------------------------|-----------------------------|
| Goodspeed, Arthur Willis.....      | Philadelphia, Pa.           |
| Heisenberg, Werner.....            | Leipzig, Germany            |
| Humphreys, William Jackson.....    | Washington, D. C.           |
| Ives, Herbert E.....               | Montclair, N. J.            |
| Larmor, Joseph.....                | Holywood, Northern Ireland  |
| Lawrence, Ernest Orlando.....      | Berkeley, Calif.            |
| Loomis, Alfred Lee.....            | Tuxedo Park, N. Y.          |
| Lyman, Theodore.....               | Cambridge, Mass.            |
| Magie, William Francis.....        | Princeton, N. J.            |
| Millikan, Robert Andrews.....      | Pasadena, Calif.            |
| Mulliken, Robert Sanderson.....    | Chicago, Ill.               |
| Planck, Max.....                   | Berlin, Germany             |
| Rabi, Isidor Isaac.....            | Cambridge, Mass.            |
| Richards, Horace Clark.....        | Philadelphia, Pa.           |
| Richardson, Owen Willans.....      | Alton, Hants, England       |
| Robertson, Howard Percy.....       | Princeton, N. J.            |
| See, Thomas Jefferson Jackson..... | Vallejo, Calif.             |
| Slater, John Clarke.....           | Cambridge, Mass.            |
| Swann, William Francis Gray.....   | Swarthmore, Pa.             |
| Tate, John Torrence.....           | Minneapolis, Minn.          |
| Tolman, Richard Chace.....         | Pasadena, Calif.            |
| Van Vleck, John Hasbrouck.....     | Cambridge, Mass.            |
| Webster, David Locke.....          | Stanford University, Calif. |
| Wilson, Harold Albert.....         | Houston, Texas              |
| Zeleny, John.....                  | New Haven, Conn.            |

### *Chemistry*

|                                  |                   |
|----------------------------------|-------------------|
| Adams, Roger.....                | Urbana, Ill.      |
| Andrews, Donald Hatch.....       | Baltimore, Md.    |
| Baekeland, Leo H.....            | New York, N. Y.   |
| Bancroft, Wilder Dwight.....     | Ithaca, N. Y.     |
| deBenneville, James S.....       | Philadelphia, Pa. |
| Bogert, Marston Taylor.....      | New York, N. Y.   |
| †Bragg, William Henry.....       | London, England   |
| Clark, William Mansfield.....    | Baltimore, Md.    |
| Conant, James Bryant.....        | Cambridge, Mass.  |
| Cottrell, Frederick Gardner..... | Washington, D. C. |
| †Du Pont, Francis I.....         | Wilmington, Del.  |
| Du Pont, Pierre Samuel.....      | Wilmington, Del.  |
| Eyring, Henry.....               | Princeton, N. J.  |
| Fieser, Louis Frederick.....     | Belmont, Mass.    |

† Deceased.

|                                   |                         |
|-----------------------------------|-------------------------|
| Giauque, William Francis.....     | Berkeley, Calif.        |
| Gomberg, Moses.....               | Ann Arbor, Mich.        |
| Harkins, William Draper.....      | Chicago, Ill.           |
| Hawk, Philip Bovier.....          | Long Island City, N. Y. |
| Hopkins, B Smith.....             | Urbana, Ill.            |
| Hulett, George A.....             | Princeton, N. J.        |
| Irvine, James Colquhoun.....      | Fifeshire, Scotland     |
| Keyes, Frederick George.....      | Cambridge, Mass.        |
| Kistiakowsky, George Bogdan.....  | Cambridge, Mass.        |
| Kraus, Charles August.....        | Providence, R. I.       |
| Lamb, Arthur Becket.....          | Cambridge, Mass.        |
| Langmuir, Irving.....             | Schenectady, N. Y.      |
| Lewis, Gilbert Newton.....        | Berkeley, Calif.        |
| Mees, Charles Edward Kenneth..... | Rochester, N. Y.        |
| Northrop, John Howard.....        | Princeton, N. J.        |
| Patterson, Lamar Gray.....        | Perdido Beach, Ala.     |
| Pauling, Linus Carl.....          | Pasadena, Calif.        |
| Smyth, Charles Phelps.....        | Princeton, N. J.        |
| Stanley, Wendell Meredith.....    | Princeton, N. J.        |
| Svedberg, Theodor.....            | Upsala, Sweden          |
| Taylor, Hugh Stott.....           | Princeton, N. J.        |
| Urey, Harold Clayton.....         | Leonia, N. J.           |
| Van Slyke, Donald Dexter.....     | New York, N. Y.         |
| Whitney, Willis R.....            | Schenectady, N. Y.      |

### *Engineering*

|                                  |                             |
|----------------------------------|-----------------------------|
| Bush, Vannevar.....              | Washington, D. C.           |
| Davis, Harvey N.....             | Hoboken, N. J.              |
| Derleth, Charles, Jr.....        | Berkeley, Calif.            |
| Dunn, Gano.....                  | New York, N. Y.             |
| Durand, William Frederick.....   | Stanford University, Calif. |
| Hoover, Herbert.....             | Stanford University, Calif. |
| Hunsaker, Jerome Clarke.....     | Boston, Mass.               |
| Jackson, Dugald Caleb.....       | Cambridge, Mass.            |
| Jewett, Frank Baldwin.....       | New York, N. Y.             |
| Kármán, Theodor von.....         | Pasadena, Calif.            |
| Kettering, Charles Franklin..... | Dayton, Ohio                |
| Pender, Harold.....              | Philadelphia, Pa.           |
| Timoshenko, Stephen P.....       | Palo Alto, Calif.           |
| Wetherill, Samuel Price.....     | Philadelphia, Pa.           |
| Yeatman, Pope.....               | New York, N. Y.             |

## CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

### *Geology, Paleontology, Geography*

|                              |                             |
|------------------------------|-----------------------------|
| Adams, Frank Dawson.....     | Montreal, Canada            |
| Berkey, Charles Peter.....   | New York, N. Y.             |
| Berry, Edward Wilber.....    | Baltimore, Md.              |
| Blackwelder, Elliot.....     | Stanford University, Calif. |
| Bowen, Norman L.....         | Chicago, Ill.               |
| Bowman, Isaiah.....          | Baltimore, Md.              |
| Bryant, William L.....       | Providence, R. I.           |
| Buddington, Arthur F.....    | Princeton, N. J.            |
| Byrd, Richard Evelyn.....    | Boston, Mass.               |
| Case, Ermine Cowles.....     | Ann Arbor, Mich.            |
| Cross, Whitman.....          | Chevy Chase, Md.            |
| Daly, Reginald Aldworth..... | Cambridge, Mass.            |
| Day, Arthur L.....           | Bethesda, Md.               |
| Gregory, Herbert Ernest..... | Honolulu, Hawaii            |
| Gregory, William King.....   | New York, N. Y.             |
| Hobbs, William Herbert.....  | Ann Arbor, Mich.            |
| Johnson, Douglas.....        | New York, N. Y.             |
| Lawson, Andrew Cowper.....   | Berkeley, Calif.            |
| Leith, Charles Kenneth.....  | Madison, Wis.               |
| Leverett, Frank.....         | Ann Arbor, Mich.            |
| de Margerie, Emmanuel.....   | Paris, France               |
| Merriam, John C.....         | Pasadena, Calif.            |
| Penck, Albrecht F. K.....    | Berlin, Germany             |
| Reid, Harry Fielding.....    | Baltimore, Md.              |
| Schuchert, Charles.....      | New Haven, Conn.            |
| Scott, William Berryman..... | Princeton, N. J.            |
| Simpson, George Gaylord..... | New York, N. Y.             |
| Stefansson, Vilhjalmur.....  | New York, N. Y.             |
| Vaughan, Thomas Wayland..... | Washington, D. C.           |
| Warren, Charles Hyde.....    | New Haven, Conn.            |
| Wilkins, Hubert.....         | New York, N. Y.             |
| Willis, Bailey.....          | Stanford University, Calif. |
| Wright, Frederick E.....     | Washington, D. C.           |

### *Zoology, Anatomy*

|                            |                  |
|----------------------------|------------------|
| Andrews, Roy Chapman ..... | New York, N. Y.  |
| Barbour, Thomas.....       | Boston, Mass.    |
| Bigelow, Henry Bryant..... | Cambridge, Mass. |
| Birge, Edward Asahel.....  | Madison, Wis.    |

|                                  |                                  |
|----------------------------------|----------------------------------|
| Bumpus, Hermon Carey.....        | Duxbury, Mass.                   |
| Calvert, Philip Powell.....      | Cheyney, Pa.                     |
| Castle, William Ernest.....      | Berkeley, Calif.                 |
| Chapman, Frank Michler.....      | New York, N. Y.                  |
| Cockerell, Theodore D. A.....    | Boulder, Colo.                   |
| Conklin, Edwin Grant.....        | Princeton, N. J.                 |
| Corner, George Washington.....   | Baltimore, Md.                   |
| Dahlgren, Ulric.....             | Princeton, N. J.                 |
| Davenport, Charles Benedict..... | Cold Spring Harbor, L. I., N. Y. |
| Detwiler, Samuel Randall.....    | New York, N. Y.                  |
| Harrison, Ross G.....            | New Haven, Conn.                 |
| Hisaw, Frederick Lee.....        | Cambridge, Mass.                 |
| Hjort, Johan.....                | Oslo, Norway                     |
| Howard, Leland Ossian.....       | Washington, D. C.                |
| Jennings, Herbert S.....         | Los Angeles, Calif.              |
| Kofoed, Charles A.....           | Berkeley, Calif.                 |
| Lillie, Frank Rattray.....       | Chicago, Ill.                    |
| McClung, Clarence El.....        | Philadelphia, Pa.                |
| McClure, Charles F. W.....       | Princeton, N. J.                 |
| McGregor, James Howard.....      | New York, N. Y.                  |
| Mark, Edward Laurens.....        | Cambridge, Mass.                 |
| Metz, Charles William.....       | Philadelphia, Pa.                |
| Miller, Gerrit Smith, Jr.....    | Washington, D. C.                |
| Moore, J. Percy.....             | Philadelphia, Pa.                |
| Morgan, Thomas Hunt.....         | Pasadena, Calif.                 |
| Painter, Theophilus Shickel..... | Austin, Texas                    |
| Parker, George Howard.....       | Cambridge, Mass.                 |
| Ruthven, Alexander G.....        | Ann Arbor, Mich.                 |
| Schaeffer, J. Parsons.....       | Philadelphia, Pa.                |
| Schultz, Adolph H.....           | Baltimore, Md.                   |
| Sturtevant, Alfred Henry.....    | Pasadena, Calif.                 |
| Sumner, Francis Bertody.....     | La Jolla, Calif.                 |
| Taliaferro, William Hay.....     | Chicago, Ill.                    |
| Thompson, D'Arcy Wentworth.....  | St. Andrews, Scotland            |
| Wetmore, Alexander.....          | Washington, D. C.                |
| Wright, Sewall.....              | Chicago, Ill.                    |

*Botany, Bacteriology*

|                              |                  |
|------------------------------|------------------|
| Allen, Charles Elmer.....    | Madison, Wis.    |
| Arthur, Joseph Charles.....  | Lafayette, Ind.  |
| Bailey, Irving Widmer.....   | Cambridge, Mass. |
| Bailey, Liberty Hyde.....    | Ithaca, N. Y.    |
| Bartlett, Harley Harris..... | Ann Arbor, Mich. |

|                                 |                                  |
|---------------------------------|----------------------------------|
| Blakeslee, Albert Francis.....  | Cold Spring Harbor, L. I., N. Y. |
| Campbell, Douglas Houghton..... | Stanford University, Calif.      |
| Cleland, Ralph Erskine.....     | Bloomington, Ind.                |
| Crocker, William.....           | Yonkers, N. Y.                   |
| Davis, Bradley Moore.....       | Ann Arbor, Mich.                 |
| Duggar, Benjamin Minge.....     | Madison, Wis.                    |
| Fernald, Merritt Lyndon.....    | Cambridge, Mass.                 |
| Harper, Robert A.....           | New York, N. Y.                  |
| Jones, Lewis Ralph.....         | Madison, Wis.                    |
| Livingston, Burton E.....       | Riderwood, Md.                   |
| MacDougal, Daniel Trembly.....  | Carmel, Calif.                   |
| Macfarlane, John Muirhead.....  | Paoli, Pa.                       |
| Merrill, Elmer Drew.....        | Jamaica Plain, Mass.             |
| Moore, George Thomas.....       | St. Louis, Mo.                   |
| Novy, Frederick G.....          | Ann Arbor, Mich.                 |
| Prain, David.....               | Whyteleafe, Surrey, England      |
| Robbins, William Jacob.....     | New York, N. Y.                  |
| Schramm, Jacob Richard.....     | Philadelphia, Pa.                |
| Setchell, William Albert.....   | Berkeley, Calif.                 |
| Shull, George Harrison.....     | Princeton, N. J.                 |
| Sinnott, Edmund Ware.....       | New Haven, Conn.                 |
| Spoechr, Herman Augustus.....   | Stanford University, Calif.      |
| Stadler, Lewis John.....        | Columbia, Mo.                    |
| Stakman, Elvin Charles.....     | St. Paul, Minn.                  |
| Trelease, William.....          | Urbana, Ill.                     |

*Anthropology, Psychology*

|                             |                            |
|-----------------------------|----------------------------|
| Angell, James Rowland.....  | New Haven, Conn.           |
| Boas, Franz.....            | Grantwood, N. J.           |
| Cattell, James McKeen.....  | Garrison, N. Y.            |
| Cole, Fay-Cooper.....       | Chicago, Ill.              |
| Hooton, Earnest A.....      | Cambridge, Mass.           |
| Hrdlička, Aleš.....         | Washington, D. C.          |
| Hunter, Walter Samuel.....  | Providence, R. I.          |
| Janet, Pierre.....          | Paris, France              |
| Keith, Arthur.....          | Farnborough, Kent, England |
| Köhler, Wolfgang.....       | Swarthmore, Pa.            |
| Lashley, Karl Spencer.....  | Cambridge, Mass.           |
| MacCurdy, George Grant..... | Old Lyme, Conn.            |
| †Paton, Stewart.....        | New York, N. Y.            |
| Thorndike, Edward L.....    | New York, N. Y.            |

† Deceased.

|                                 |                  |
|---------------------------------|------------------|
| Tozzer, Alfred Marston.....     | Cambridge, Mass. |
| Wissler, Clark.....             | New York, N. Y.  |
| Witmer, Lightner.....           | Devon, Pa.       |
| Woodworth, Robert Sessions..... | New York, N. Y.  |
| Yerkes, Robert Mearns.....      | New Haven, Conn. |

*Physiology, Pathology*

|                                 |                                  |
|---------------------------------|----------------------------------|
| Adrian, Edgar Douglas.....      | Cambridge, England               |
| Benedict, Francis Gano.....     | Machiasport, Maine               |
| Bronk, Detlev W.....            | Philadelphia, Pa.                |
| Brubaker, Albert P.....         | Philadelphia, Pa.                |
| Cannon, Walter Bradford.....    | Boston, Mass.                    |
| Carlson, Anton Julius.....      | Chicago, Ill.                    |
| Chittenden, Russell H.....      | New Haven, Conn.                 |
| Dale, Henry Hallett.....        | London, England                  |
| Erlanger, Joseph.....           | St. Louis, Mo.                   |
| Flexner, Simon.....             | New York, N. Y.                  |
| Forbes, Alexander.....          | Boston, Mass.                    |
| †Fox, Herbert.....              | Philadelphia, Pa.                |
| Gasser, Herbert Spencer.....    | New York, N. Y.                  |
| Gies, William J.....            | New York, N. Y.                  |
| Harvey, E. Newton.....          | Princeton, N. J.                 |
| Hastings, Albert Baird.....     | Brookline, Mass.                 |
| †Henderson, Lawrence J.....     | Cambridge, Mass.                 |
| Henderson, Yandell.....         | New Haven, Conn.                 |
| Hill, Archibald Vivian.....     | London, England                  |
| Hopkins, Frederick Gowland..... | Cambridge, England               |
| Howell, William Henry.....      | Baltimore, Md.                   |
| Jacobs, Merkel Henry.....       | Philadelphia, Pa.                |
| Krogh, August.....              | Copenhagen, Denmark              |
| Landsteiner, Karl.....          | New York, N. Y.                  |
| Lillie, Ralph Stayner.....      | Chicago, Ill.                    |
| Loeb, Leo.....                  | St. Louis, Mo.                   |
| Long, Esmond Ray.....           | Philadelphia, Pa.                |
| Murlin, John Raymond.....       | Rochester, N. Y.                 |
| Osterhout, Winthrop J. V.....   | New York, N. Y.                  |
| Richards, Alfred Newton.....    | Bryn Mawr, Pa.                   |
| Riddle, Oscar.....              | Cold Spring Harbor, L. I., N. Y. |
| Tyzzer, Ernest Edward.....      | Wakefield, Mass.                 |
| Whipple, George Hoyt.....       | Rochester, N. Y.                 |

† Deceased.



*Medicine, Pharmacology, Surgery*

|                                    |                    |
|------------------------------------|--------------------|
| Carrel, Alexis.....                | New York, N. Y.    |
| Castle, William Bosworth.....      | Boston, Mass.      |
| Crile, George.....                 | Cleveland, Ohio    |
| Darrach, William.....              | New York, N. Y.    |
| DuBois, Eugene Floyd.....          | New York, N. Y.    |
| Graham, Evarts Ambrose.....        | St. Louis, Mo.     |
| Heiser, Victor George.....         | Bantam, Conn.      |
| Joslin, Elliott Proctor.....       | Boston, Mass.      |
| MacNider, William de Berniere..... | Chapel Hill, N. C. |
| Minot, George Richards.....        | Boston, Mass.      |
| Norris, George William.....        | Dimock, Pa.        |
| Packard, Francis Randolph.....     | Philadelphia, Pa.  |
| Pepper, William.....               | Philadelphia, Pa.  |
| Ravenel, Mazýck P.....             | Columbia, Mo.      |
| Rous, Peyton.....                  | New York, N. Y.    |

## CLASS III. SOCIAL SCIENCES

*Economics, Statistics, Sociology*

|                               |                      |
|-------------------------------|----------------------|
| Commons, John Rogers.....     | Ft. Lauderdale, Fla. |
| Day, Edmund Ezra.....         | Ithaca, N. Y.        |
| Dodds, Harold Willis.....     | Princeton, N. J.     |
| Fetter, Frank Albert.....     | Princeton, N. J.     |
| Fisher, Irving.....           | New Haven, Conn.     |
| Gay, Edwin Francis.....       | Pasadena, Calif.     |
| Heckscher, Eli Filip.....     | Stockholm, Sweden    |
| Huebner, Solomon Stephen..... | Merion, Pa.          |
| Johnson, Emory R.....         | Philadelphia, Pa.    |
| Kemmerer, Edwin Walter.....   | Princeton, N. J.     |
| Mitchell, Wesley Clair.....   | New York, N. Y.      |
| Moulton, Harold Glenn.....    | Washington, D. C.    |
| Ogburn, William Fielding..... | Chicago, Ill.        |
| Patterson, Ernest Minor.....  | Philadelphia, Pa.    |
| Rappard, William E.....       | Geneva, Switzerland  |
| Rist, Charles.....            | Versailles, France   |
| Sprague, Oliver M. W.....     | Boston, Mass.        |
| Willits, Joseph Henry.....    | New York, N. Y.      |
| Wilson, Edwin Bidwell.....    | Boston, Mass.        |
| Wolman, Leo.....              | New York, N. Y.      |
| Young, James Thomas.....      | Philadelphia, Pa.    |

*Modern History*

|                                    |                         |
|------------------------------------|-------------------------|
| Adams, James Truslow.....          | Southport, Conn.        |
| Andrews, Charles McLean.....       | New Haven, Conn.        |
| Armstrong, Hamilton Fish.....      | New York, N. Y.         |
| Beard, Charles Austin.....         | New Milford, Conn.      |
| Becker, Carl L.....                | Ithaca, N. Y.           |
| Bolton, Herbert Eugene.....        | Berkeley, Calif.        |
| Cheyney, Edward Potts.....         | Media, Pa.              |
| Farrand, Max.....                  | Bar Harbor, Maine       |
| Ford, Guy Stanton.....             | Washington, D. C.       |
| Fox, Dixon Ryan.....               | Schenectady, N. Y.      |
| Gooch, George Peabody.....         | London, England         |
| Greene, Evarts B.....              | Croton-on-Hudson, N. Y. |
| Hayes, Carlton Joseph Huntley..... | New York, N. Y.         |
| Lingelbach, William E.....         | Philadelphia, Pa.       |
| McIlwain, Charles Howard.....      | Belmont, Mass.          |
| Morison, Samuel Eliot.....         | Cambridge, Mass.        |
| Read, Conyers.....                 | Philadelphia, Pa.       |
| Schlesinger, Arthur Meier.....     | Cambridge, Mass.        |
| Seymour, Charles.....              | New Haven, Conn.        |
| Shotwell, James Thomson.....       | New York, N. Y.         |
| Sioussat, St. George Leakin.....   | Washington, D. C.       |
| Wertenbaker, Thomas Jefferson..... | Princeton, N. J.        |

*Jurisprudence*

|                                  |                         |
|----------------------------------|-------------------------|
| Chamberlain, Joseph Perkins..... | New York, N. Y.         |
| Corwin, Edward Samuel.....       | Princeton, N. J.        |
| Davis, John William.....         | New York, N. Y.         |
| Dickinson, John.....             | Philadelphia, Pa.       |
| Duane, Morris.....               | Philadelphia, Pa.       |
| Frankfurter, Felix.....          | Washington, D. C.       |
| Goodrich, Herbert Funk.....      | Philadelphia, Pa.       |
| Hudson, Manley Ottmer.....       | Cambridge, Mass.        |
| Hughes, Charles Evans.....       | Washington, D. C.       |
| Jessup, Philip C.....            | New York, N. Y.         |
| Miller, Hunter.....              | Victoria, B. C., Canada |
| Moore, John Bassett.....         | New York, N. Y.         |
| Morris, Roland S.....            | Philadelphia, Pa.       |
| Pepper, George Wharton.....      | Philadelphia, Pa.       |
| Pound, Roscoe.....               | Watertown, Mass.        |
| Reeves, Jesse S.....             | Ann Arbor, Mich.        |

|                             |                   |
|-----------------------------|-------------------|
| Roberts, Owen J.....        | Washington, D. C. |
| Rogers, Lindsay.....        | New York, N. Y.   |
| Scott, James Brown.....     | Annapolis, Md.    |
| Scott, John Morin.....      | Philadelphia, Pa. |
| Stone, Harlan Fiske.....    | Washington, D. C. |
| Warren, Charles.....        | Washington, D. C. |
| Wilson, George Grafton..... | Cambridge, Mass.  |

*Administration, Government*

|                                 |                     |
|---------------------------------|---------------------|
| Beneš, Eduard.....              | London, England     |
| Butler, Nicholas Murray.....    | New York, N. Y.     |
| Crane, Robert Treat.....        | New York, N. Y.     |
| Delano, Frederic Adrian.....    | Washington, D. C.   |
| Fosdick, Raymond Blaine.....    | New York, N. Y.     |
| Gates, Thomas Sovereign.....    | Philadelphia, Pa.   |
| Gifford, Walter Sherman.....    | New York, N. Y.     |
| Keith, Arthur Berriedale.....   | Edinburgh, Scotland |
| Lowell, Abbott Lawrence.....    | Boston, Mass.       |
| McClelland, George William..... | Philadelphia, Pa.   |
| Merriam, Charles Edward.....    | Chicago, Ill.       |
| Putnam, Herbert.....            | Washington, D. C.   |
| Rockefeller, John D., Jr.....   | New York, N. Y.     |
| Rowe, Leo S.....                | Washington, D. C.   |
| Schurman, Jacob Gould.....      | New York, N. Y.     |
| Young, Owen D.....              | New York, N. Y.     |

*Affairs*

|                                |                   |
|--------------------------------|-------------------|
| Fels, Samuel S.....            | Philadelphia, Pa. |
| Hayward, Nathan.....           | Philadelphia, Pa. |
| Hopkinson, Edward, Jr.....     | Philadelphia, Pa. |
| Jenks, John Story.....         | Philadelphia, Pa. |
| Johnson, Eldridge Reeves.....  | Camden, N. J.     |
| Lamont, Thomas William.....    | New York, N. Y.   |
| Leeds, Morris Evans.....       | Philadelphia, Pa. |
| Mason, William Smith.....      | Evanston, Ill.    |
| Morgan, Marshall S.....        | Malvern, Pa.      |
| Morris, Lawrence J.....        | Philadelphia, Pa. |
| Norris, George Washington..... | Philadelphia, Pa. |
| Rhoads, Charles James.....     | Bryn Mawr, Pa.    |
| Rosengarten, Adolph G.....     | St. Davids, Pa.   |
| Scattergood, J. Henry.....     | Villa Nova, Pa.   |

## CLASS IV. HUMANITIES

*Philosophy, Education*

|                               |                   |
|-------------------------------|-------------------|
| Dewey, John.....              | New York, N. Y.   |
| Graves, Frank Pierrepont..... | Albany, N. Y.     |
| Haney, John Louis.....        | Philadelphia, Pa. |
| Hu Shih.....                  | Washington, D. C. |
| Keppel, Frederick Paul.....   | New York, N. Y.   |
| Lovejoy, Arthur Oncken.....   | Baltimore, Md.    |
| Perry, Ralph Barton.....      | Cambridge, Mass.  |
| Singer, Edgar Arthur, Jr..... | Philadelphia, Pa. |

*Ancient, Medieval and Cultural History*

|                                 |                   |
|---------------------------------|-------------------|
| Bell, Harold Idris.....         | London, England   |
| Chinard, Gilbert.....           | Princeton, N. J.  |
| Cumont, Franz Valery Marie..... | Rome, Italy       |
| Ferguson, William Scott.....    | Cambridge, Mass.  |
| Leland, Waldo G.....            | Washington, D. C. |
| Noek, Arthur Darby.....         | Cambridge, Mass.  |
| Rostovtzeff, Michael I.....     | New Haven, Conn.  |
| Sarton, George.....             | Cambridge, Mass.  |
| Thorndike, Lynn.....            | New York, N. Y.   |

*Archaeology, History of Art and Architecture*

|                                   |                           |
|-----------------------------------|---------------------------|
| Albright, William F.....          | Baltimore, Md.            |
| Barton, George Aaron.....         | Coconut Grove, Fla.       |
| Blegen, Carl William.....         | Cincinnati, Ohio          |
| Carpenter, Rhys.....              | Downingtown, Pa.          |
| Chase, George Henry.....          | Cambridge, Mass.          |
| Cret, Paul Philippe.....          | Philadelphia, Pa.         |
| Dinsmoor, William Bell.....       | New York, N. Y.           |
| Holland, Leicester Bodine.....    | Philadelphia, Pa.         |
| Jayne, Horace Howard Furness..... | New York, N. Y.           |
| Kenyon, Frederic George.....      | Godstone, Surrey, England |
| Kidder, Alfred Vincent.....       | Cambridge, Mass.          |
| Kroeber, Alfred Louis.....        | Berkeley, Calif.          |
| Meritt, Benjamin Dean.....        | Princeton, N. J.          |
| Morley, Sylvanus Griswold.....    | Merida, Yucatan, Mexico   |
| Nilsson, Martin P.....            | Lund, Sweden              |
| Petrie, Flinders.....             | Jerusalem, Palestine      |
| Reisner, George Andrew.....       | Boston, Mass.             |
| Robinson, David Moore.....        | Baltimore, Md.            |

|                              |                   |
|------------------------------|-------------------|
| Shear, Theodore Leslie.....  | Princeton, N. J.  |
| Stein, Aurel.....            | Srinagar, Kashmir |
| Winlock, Herbert Eustis..... | New York, N. Y.   |

*Languages and Literary History*

|                                  |                     |
|----------------------------------|---------------------|
| Armstrong, Edward Cooke.....     | Princeton, N. J.    |
| Beeson, Charles Henry.....       | Chicago, Ill.       |
| Bonner, Campbell.....            | Ann Arbor, Mich.    |
| Buck, Carl Darling.....          | Chicago, Ill.       |
| Capps, Edward.....               | Princeton, N. J.    |
| Edgerton, Franklin.....          | New Haven, Conn.    |
| Gulick, Charles Burton.....      | Cambridge, Mass.    |
| Hendrickson, George Lincoln..... | New Haven, Conn.    |
| Lancaster, Henry Carrington..... | Baltimore, Md.      |
| McDaniel, Walton Brooks.....     | Coconut Grove, Fla. |
| Matthews, Albert.....            | Boston, Mass.       |
| Montgomery, James Alan.....      | Philadelphia, Pa.   |
| Nitze, William Albert.....       | Chicago, Ill.       |
| Pidal, Ramón Menéndez.....       | Madrid, Spain       |
| Prince, John Dyneley.....        | New York, N. Y.     |
| Rand, Edward Kennard.....        | Cambridge, Mass.    |
| Rolfe, John Carew.....           | Philadelphia, Pa.   |
| Sanders, Henry A.....            | Ann Arbor, Mich.    |
| Speiser, Ephraim Avigdor.....    | Wynnewood, Pa.      |
| Sturtevant, Edgar Howard.....    | New Haven, Conn.    |
| Tatlock, John S. P.....          | Berkeley, Calif.    |
| Toynbee, Arnold Joseph.....      | London, England     |

*Letters and Fine Arts*

|                                |                          |
|--------------------------------|--------------------------|
| Adams, Joseph Quincy.....      | Washington, D. C.        |
| Ayclotte, Frank.....           | Princeton, N. J.         |
| Brooke, C. F. Tucker.....      | New Haven, Conn.         |
| Brooks, Van Wyck.....          | Westport, Conn.          |
| Cather, Willa.....             | New York, N. Y.          |
| Cross, Wilbur L.....           | New Haven, Conn.         |
| Damrosch, Walter Johannes..... | New York, N. Y.          |
| Frost, Robert.....             | South Shaftsbury, Vt.    |
| Jones, Howard Mumford.....     | Cambridge, Mass.         |
| Lowes, John Livingston.....    | Cambridge, Mass.         |
| Lydenberg, Harry Miller.....   | Mexico City, Mexico      |
| Mather, Frank Jewett, Jr.....  | Washington Crossing, Pa. |
| Morey, Charles Rufus.....      | Princeton, N. J.         |

|                                |                   |
|--------------------------------|-------------------|
| Morris, Harrison Smith.....    | Philadelphia, Pa. |
| Mumford, Lewis.....            | Amenia, N. Y.     |
| Nicolson, Marjorie Hope.....   | New York, N. Y.   |
| O'Neill, Eugene Gladstone..... | Danville, Calif.  |
| Phelps, William Lyon.....      | New Haven, Conn.  |
| Quinn, Arthur Hobson.....      | Bala-Cynwyd, Pa.  |
| Repplier, Agnes.....           | Philadelphia, Pa. |
| Rosenbach, A. S. W.....        | Philadelphia, Pa. |
| Schelling, Felix E.....        | Mt. Vernon, N. Y. |
| Taylor, Deems.....             | Stamford, Conn.   |

## GEOGRAPHICAL OR PROFESSIONAL LOCATIONS OF MEMBERS

— — —

### RESIDENTS OF THE UNITED STATES

#### Alabama

##### PERDIDO BEACH

Patterson, Lamar Gray

#### Arizona

##### FLAGSTAFF

Lampland, Carl O.

Slipher, Vesto Melvin

##### TUCSON

Douglass, Andrew Ellicott

#### California

##### BERKELEY

Aitken, Robert Grant

Bolton, Herbert Eugene

Castle, William Ernest

Derleth, Charles, Jr.

Evans, Griffith Conrad

Giauque, William Francis

Kofoid, Charles A.

Kroeber, Alfred Louis

Lawrence, Ernest Orlando

Lawson, Andrew Cowper

Leuschner, Armin Otto

Lewis, Gilbert Newton

Setchell, William Albert

Tatlock, J. S. P.

##### CARMEL

MacDougal, Daniel Trembly

##### DANVILLE

O'Neill, Eugene Gladstone

#### LA JOLLA

Sumner, Francis Bertody

#### LOS ANGELES

Jennings, Herbert S.

#### MT. HAMILTON

Wright, William Hammond

#### PALO ALTO

Tucker, Richard Hawley

#### PASADENA

Adams, Walter Sydney

Anderson, Carl David

Bateman, Harry

Bell, Eric Temple

Bowen, Ira Sprague

Gay, Edwin Francis

Hubble, Edwin P.

Kármán, Theodor von

Merriam, John C.

Merrill, Paul Willard

Millikan, Robert Andrews

Morgan, Thomas Hunt

Pauling, Linus Carl

Searcs, Frederick Hanley

Sturtevant, Alfred Henry

Tolman, Richard Chace

#### STANFORD UNIVERSITY

Blackwelder, Eliot

Campbell, Douglas Houghton

Durand, William Frederick

Hoover, Herbert  
 Spoehr, Herman Augustus  
 Timoshenko, Stephen P.  
 Webster, David Locke  
 Willis, Bailey

VALLEJO  
 See, Thomas Jefferson Jackson

### Colorado

BOULDER  
 Cockerell, Theodore D. A.

### Connecticut

BANTAM  
 Heiser, Victor George

### NEW HAVEN

Andrews, Charles McLean  
 Angell, James Rowland  
 Brooke, C. F. Tucker  
 Chittenden, Russell H.  
 Cross, Wilbur L.  
 Edgerton, Franklin  
 Fisher, Irving  
 Harrison, Ross G.  
 Henderson, Yandell  
 Hendrickson, George Lincoln  
 Phelps, William Lyon  
 Rostovtzeff, Michael I.  
 Schlesinger, Frank  
 Schuchert, Charles  
 Seymour, Charles  
 Sinnott, Edmund Ware  
 Sturtevant, Edgar Howard  
 Warren, Charles Hyde  
 Yerkes, Robert Mearns  
 Zeleny, John

### NEW MILFORD

Beard, Charles Austin

### OLD LYME

MacCurdy, George Grant

† Deceased.

### SOUTHPORT

Adams, James Truslow

### STAMFORD

Taylor, Deems

### WESTPORT

Brooks, Van Wyck

### Delaware

### WILMINGTON

† Du Pont, Francis I.  
 Du Pont, Pierre Samuel

### District of Columbia

### WASHINGTON

Abbot, Charles Greeley  
 Adams, Joseph Quincy  
 Briggs, Lyman J.  
 Bush, Vannevar  
 Cottrell, Frederick Gardner  
 Cross, Whitman  
 Day, Arthur L.  
 Delano, Frederic Adrian  
 Ford, Guy Stanton  
 Frankfurter, Felix  
 Howard, Leland Ossian  
 Hrdlička, Aleš  
 Hu Shih  
 Hughes, Charles Evans  
 Humphreys, William Jackson  
 Leland, Waldo G.  
 Miller, Gerrit Smith, Jr.  
 Moulton, Forest Ray  
 Moulton, Harold Glenn  
 Putnam, Herbert  
 Roberts, Owen J.  
 Rowe, Leo S.  
 Sioussat, St. George Leakin  
 Stone, Harlan Fiske  
 Vaughan, Thomas Wayland  
 Warren, Charles  
 Wetmore, Alexander  
 Wright, Frederick E.



**Florida****COCONUT GROVE**

Barton, George Aaron  
McDaniel, Walton Brooks

**FT. LAUDERDALE**

Commons, John Rogers

**Hawaii****HONOLULU**

Gregory, Herbert Ernest

**Illinois****CHICAGO**

Beecon, Charles Henry  
Bliss, Gilbert Ames  
Bowen, Norman L.  
Buck, Carl Darling  
Carlson, Anton Julius  
Cole, Fay-Cooper  
Compton, Arthur Holly  
Dempster, Arthur Jeffrey  
Franck, James  
Harkins, William Draper  
Lillie, Frank Rattray  
Lillie, Ralph Stayner  
Merriam, Charles Edward  
Mulliken, Robert Sanderson  
Nitze, William Albert  
Ogburn, William Fielding  
Taliaferro, William Hay  
Wright, Sewall

**EVANSTON**

Crew, Henry  
Mason, William Smith

**URBANA**

Adams, Roger  
Coble, Arthur Byron  
Hopkins, B Smith  
Trelease, William

**Indiana****BLOOMINGTON**

Cleland, Ralph Erskine

**LAFAYETTE**

Arthur, Joseph Charles

**Maine****BAR HARBOR**

Farrand, Max

**MACHIASPORT**

Benedict, Francis Gano

**Maryland****ANNAPOLIS**

Scott, James Brown

**BALTIMORE**

Albright, William F.  
Andrews, Donald Hatch  
Berry, Edward Wilber  
Bowman, Isaiah  
Clark, William Mansfield  
Corner, George Washington  
Howell, William Henry  
Lancaster, Henry Carrington  
Livingston, Burton E.  
Lovejoy, Arthur Oncken  
Reid, Harry Fielding  
Robinson, David Moore  
Schultz, Adolph H.

**Massachusetts****BOSTON**

Byrd, Richard Evelyn  
Cannon, Walter Bradford  
Castle, William Bosworth  
Forbes, Alexander  
Hastings, Albert Baird  
Joslin, Elliott Proctor  
Matthews, Albert  
Merrill, Elmer Drew  
Minot, George Richards

Reisner, George Andrew  
 Sprague, Oliver M. W.  
 Tyzzer, Ernest Edward  
 Wilson, Edwin Bidwell

## CAMBRIDGE

Bailey, Irving Widmer  
 Barbour, Thomas  
 Bigelow, Henry Bryant  
 Birkhoff, George David  
 Bridgman, Percy Williams  
 Chase, George Henry  
 Compton, Karl Taylor  
 Conant, James Bryant  
 Daly, Reginald Aldworth  
 Ferguson, William Scott  
 Fernald, Merritt Lyndon  
 Fieser, Louis Frederick  
 Gaposchkin, Cecilia Payne  
 Gnlick, Charles Burton  
 †Henderson, Lawrence J.  
 Hisaw, Frederick Lee  
 Hooton, Earnest A.  
 Hudson, Manley Ottmer  
 Hunsaker, Jerome Clarke  
 Huntington, Edward V.  
 Jackson, Dugald Caleb  
 Jones, Howard Mumford  
 Keyes, Frederick George  
 Kidder, Alfred Vincent  
 Kistiakowsky, George B.  
 Lamb, Arthur Becket  
 Lashley, Karl Spencer  
 Lowell, Abbott Lawrence  
 Lowes, John Livingston  
 Lyman, Theodore  
 McIlwain, Charles Howard  
 Mark, Edward Laurens  
 Morison, Samuel Eliot  
 Nock, Arthur Darby  
 Osgood, William Fogg  
 Parker, George Howard

† Deceased.

Perry, Ralph Barton  
 Pound, Roscoe  
 Rabi, Isidor Isaac  
 Rand, Edward Kennard  
 Sarton, George  
 Schlesinger, Arthur Meier  
 Shapley, Harlow  
 Slater, John Clarke  
 Tozzer, Alfred Marston  
 Van Vleck, John Hasbrouck  
 Wilson, George Grafton

## DUXBURY

Bumpus, Hermon Carey

## Michigan

## ANN ARBOR

Bartlett, Harley Harris  
 Bonner, Campbell  
 Case, Ermine Cowles  
 †Curtis, Heber Doust  
 Davis, Bradley Moore  
 Gomberg, Moses  
 Hobbs, William Herbert  
 Leverett, Frank  
 Novy, Frederick G.  
 Reeves, Jesse S.  
 Ruthven, Alexander G.  
 Sanders, Henry A.

## Minnesota

## MINNEAPOLIS

Tate, John Torrence

## ST. PAUL

Stakman, Elvin Charles

## Missouri

## COLUMBIA

Ravenel, Mazyck  
 Stadler, Lewis John

## ST. LOUIS

Erlanger, Joseph  
 Graham, Evarts Ambrose  
 Loeb, Leo  
 Moore, George Thomas

## New Jersey

## CAMDEN

Johnson, Eldridge Reeves

## HOBOKEN

Davis, Harvey Nathaniel

## PRINCETON

Adams, Edwin Plimpton  
 Alexander, James W.  
 Armstrong, Edward Cooke  
 Aydelotte, Frank  
 Buddington, Arthur F.  
 Capps, Edward  
 Chinard, Gilbert  
 Conklin, Edwin Grant  
 Corwin, Edward Samuel  
 Dahlgren, Ulric  
 Dodds, Harold Willis  
 Einstein, Albert  
 Eisenhart, Luther Pfahler  
 Eyring, Henry  
 Fetter, Frank Albert  
 Harvey, E. Newton  
 Hulett, George A.  
 Kemmerer, Edwin Walter  
 Lefschetz, Solomon  
 McClure, Charles F. W.  
 Magie, William Francis  
 Mather, Frank Jewett, Jr.  
 Meritt, Benjamin Dean  
 Morey, Charles Rufus  
 Morse, Marston  
 von Neumann, John  
 Northrop, John Howard  
 Robertson, Howard Percy  
 Russell, Henry Norris  
 Scott, William Berryman

Shear, Theodore Leslie  
 Shull, George Harrison  
 Smyth, Charles Phelps  
 Stanley, Wendell Meredith  
 Taylor, Hugh Stott  
 Veblen, Oswald  
 Wertenbaker, Thomas J.  
 Weyl, Hermann

## New York

## ALBANY

Graves, Frank Pierrepont

## AMENIA

Mumford, Lewis

## COLD SPRING HARBOR

Blakeslee, Albert Francis  
 Davenport, Charles Benedict  
 Riddle, Oscar

## CROWN POINT

Henderson, Robert

## ITHACA

Bailey, Liberty Hyde  
 Bancroft, Wilder Dwight  
 Becker, Carl L.  
 Day, Edmund Ezra  
 Debye, Peter

## NEW YORK

Andrews, Roy Chapman  
 Armstrong, Hamilton Fish  
 Baekeland, Leo H.  
 Berkey, Charles Peter  
 Boas, Franz  
 Bogert, Marston Taylor  
 Butler, Nicholas Murray  
 Carrel, Alexis  
 Cather, Willa  
 Cattell, James McKeen  
 Chamberlain, Joseph Perkins  
 Chapman, Frank Michler

Crane, Robert Treat  
 Crocker, William  
 Damrosch, Walter Johannes  
 Darrach, William  
 Darrow, Karl Kelehner  
 Davis, John William  
 Davisson, Clinton J.  
 Detwiler, Samuel Randall  
 Dewey, John  
 Dinsmoor, William Bell  
 DuBois, Eugene Floyd  
 Dunn, Gano  
 Fermi, Enrico  
 Flexner, Simon  
 Fosdick, Raymond Blaine  
 Gasser, Herbert Spencer  
 Gies, William J.  
 Gifford, Walter Sherman  
 Greene, Evarts B.  
 Gregory, William King  
 Harper, Robert A.  
 Hawk, Philip Bovier  
 Hayes, Carlton J. H.  
 Ives, Herbert E.  
 Jayne, Horace H. F.  
 Jessup, Philip C.  
 Jewett, Frank Baldwin  
 Johnson, Douglas  
 Keppel, Frederick Paul  
 Lamont, Thomas William  
 Landsteiner, Karl  
 McGregor, James Howard  
 Mitchell, Wesley Clair  
 Moore, John Bassett  
 Nicolson, Marjorie Hope  
 Osterhout, Winthrop J. V.  
 †Paton, Stewart  
 Prince, John Dyneley  
 Robbins, William Jacob  
 Rockefeller, John D., Jr.  
 Rogers, Lindsay  
 Rous, Peyton  
 Schelling, Felix E.

† Deceased.

Schurman, Jacob Gould  
 Shotwell, James Thomson  
 Simpson, George Gaylord  
 Stefansson, Villhjalmur  
 Thorndike, Edward L.  
 Thorndike, Lynn  
 Urey, Harold Clayton  
 Van Slyke, Donald Dexter  
 Wilkins, Hubert  
 Willits, Joseph Henry  
 Winlock, Herbert Eustis  
 Wissler, Clark  
 Wolman, Leo  
 Woodworth, Robert Sessions  
 Yeatman, Pope  
 Young, Owen D.

#### ROCHESTER

Mees, C. E. Kenneth  
 Murlin, John Raymond  
 Whipple, George Hoyt

#### SCHENECTADY

Coolidge, William David  
 Fox, Dixon Ryan  
 Langmuir, Irving  
 Whitney, Willis R.

#### TUXEDO PARK

Loomis, Alfred Lee

#### North Carolina

#### CHAPEL HILL

MacNider, William de B.

#### Ohio

#### CINCINNATI

Blegen, Carl William

#### LEVELAND

Crile, George

#### DAYTON

Kettering, Charles Franklin

**Pennsylvania****BRYN MAWR**

Carpenter, Rhys

**PHILADELPHIA**

deBenneville, James S.

Bronk, Detlev W.

Brubaker, Albert P.

Calvert, Philip Powell

Cheyney, Edward Potts

Cret, Paul Philippe

Dickinson, John

Duane, Morris

Fels, Samuel S.

† Fox, Herbert

Gates, Thomas Sovereign

Goodrich, Herbert Funk

Goodspeed, Arthur Willis

Haney, John Louis

Hayward, Nathan

Holland, Leicester Bodine

Hopkinson, Edward, Jr.

Huebner, Solomon Stephen

Jacobs, Merkel Henry

Jenks, John Story

Johnson, Emory R.

Kline, John Robert

Leeds, Morris Evans

Lingelbach, William E.

Long, Esmond Ray

McClelland, George William

McClung, Clarence E.

Macfarlane, John Muirhead

Metz, Charles William

Mitchell, Howard Hawks

Montgomery, James Alan

Moore, J. Percy

Morgan, Marshall S.

Morris, Harrison Smith

Morris, Lawrence J.

Morris, Roland S.

Norris, George Washington

Norris, George William

Olivier, Charles P.

Packard, Francis Randolph

Patterson, Ernest Minor

Pender, Harold

Pepper, George Wharton

Pepper, William

Quinn, Arthur Hobson

Read, Conyers

Repplier, Agnes

Rhoads, Charles James

Richards, Alfred Newton

Richards, Horace Clark

Rolfe, John Carew

Rosenbach, A. S. W.

Rosengarten, Adolph G.

Scattergood, J. Henry

Schaeffer, J. Parsons

Schramm, Jacob R.

Scott, John Morin

Singer, Edgar Arthur, Jr.

Speiser, Ephraim Avigdor

Wetherill, Samuel Price

Witmer, Lightner

Young, James Thomas

**PITTSBURGH**

Foote, Paul Darwin

**SWARTHMORE**

Dresden, Arnold

Köhler, Wolfgang

Miller, John Anthony

Swann, W. F. G.

**Rhode Island****PROVIDENCE**

Bryant, William L.

Hunter, Walter Samuel

Kraus, Charles August

**Texas****AUSTIN**

Painter, Theophilus Shickel

† Deceased.

**HOUSTON**

Lovett, Edgar Odell  
Wilson, Harold Albert

**Vermont****S. SHAFTSBURY**

Frost, Robert

**Virginia****UNIVERSITY**

Beams, Jesse Wakefield  
Mitchell, Samuel Alfred

**Wisconsin****MADISON**

Allen, Charles Elmer  
Birge, Edward Asahel  
Duggar, Benjamin Minge  
Jones, Lewis Ralph  
Leith, Charles Kenneth  
Stebbins, Joel

**WILLIAMS BAY**

Struve, Otto

**FOREIGN RESIDENTS****Canada****MONTREAL**

Adams, Frank Dawson

**VICTORIA**

Miller, Hunter

**Mexico****MERIDA, YUCATAN**

Morley, Sylvanus Griswold

**MEXICO CITY**

Lydenberg, Harry Miller

**Denmark****COPENHAGEN**

Bohr, Niels Henrik David  
Krogh, August

**England****CAMBRIDGE**

Adrian, Edgar Douglas  
Dirac, Paul Adrien Maurice  
Eddington, Arthur Stanley  
Hardy, Godfrey Harold

Hopkins, Frederick Gowland  
Larmor, Joseph

**DOWNE, KENT**

Keith, Arthur

**HARPENDEN, HERTFORDSHIRE**

Fisher, Ronald Aylmer

**LONDON**

Bell, Harold Idris  
Beneš, Eduard  
†Bragg, William Henry  
Dale, Henry Hallett  
Gooch, George Peabody  
Hill, Archibald Vivian  
Kenyon, Frederic George  
Prain, David  
Richardson, Owen Willans  
Toynbee, Arnold Joseph

**France****PARIS**

de Broglie, Louis Victor  
Janet, Pierre  
de Margerie, Emmanuel  
Rist, Charles

† Deceased.

**Germany****BERLIN**

Penck, Albrecht F. K.  
Planck, Max

**GÜTTINGEN**

Hilbert, David

**LEIPZIG**

Heisenberg, Werner

**Kashmir****SRINAGAR**

Stein, Aurel

**Netherlands****LEIDEN**

Hertzprung, Ejnar

**Norway****OSLO**

Hjort, Johan

**Palestine****JERUSALEM**

Petrie, Flinders

**Scotland****EDINBURGH**

Keith, Arthur Berriedale

**ST. ANDREWS**

Irvine, James Colquhoun  
Thompson, D'Arcy W.

**Spain****MADRID**

Pidal, Ramón Menéndez

**Sweden****LUND**

Nilsson, Martin P.

**STOCKHOLM**

Heckscher, Eli Filip

**UPSALA**

Svedberg, Theodor

**Switzerland****GENEVA**

Rappard, William E.

## MEMBERS ELECTED APRIL 25, 1941

---

### CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

#### *Resident*

|                             |                    |
|-----------------------------|--------------------|
| Griffith Conrad Evans.....  | Berkeley, Calif.   |
| Henry Eyring.....           | Princeton, N. J.   |
| Louis Frederick Fieser..... | Cambridge, Mass.   |
| John Robert Kline.....      | Swarthmore, Pa.    |
| Isidor Isaac Rabi.....      | New York, N. Y.    |
| John Torrence Tate.....     | Minneapolis, Minn. |
| Theodor von Kármán.....     | Pasadena, Calif.   |

#### *Foreign*

|                           |                     |
|---------------------------|---------------------|
| Ronald Aylmer Fisher..... | London, England     |
| Ejnar Hertzprung.....     | Leiden, Netherlands |
| Theodor Svedberg.....     | Upsala, Sweden      |

### CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

#### *Resident*

|                             |                   |
|-----------------------------|-------------------|
| Fay-Cooper Cole.....        | Chicago, Ill.     |
| Evarts Ambrose Graham.....  | St. Louis, Mo.    |
| Albert Baird Hastings.....  | Brookline, Mass.  |
| Walter Samuel Hunter.....   | Providence, R. I. |
| Charles William Metz.....   | Philadelphia, Pa. |
| William Jacob Robbins.....  | New York, N. Y.   |
| Lewis John Stadler.....     | Columbia, Mo.     |
| William Hay Taliaferro..... | Chicago, Ill.     |

#### *Foreign*

|                                    |                       |
|------------------------------------|-----------------------|
| August Krogh.....                  | Copenhagen, Denmark   |
| Sir D'Arey Wentworth Thompson..... | St. Andrews, Scotland |

### CLASS III. SOCIAL SCIENCES

#### *Resident*

|                           |                  |
|---------------------------|------------------|
| Robert Treat Crane.....   | New York, N. Y.  |
| Manley Ottmer Hudson..... | Cambridge, Mass. |
| Lindsay Rogers.....       | New York, N. Y.  |



|                                  |                  |
|----------------------------------|------------------|
| Arthur Meier Schlesinger.....    | Cambridge, Mass. |
| Thomas Jefferson Wertebaker..... | Princeton, N. J. |
| Leo Wolman.....                  | New York, N. Y.  |

*Foreign*

|                         |                     |
|-------------------------|---------------------|
| William E. Rappard..... | Geneva, Switzerland |
|-------------------------|---------------------|

**CLASS IV. HUMANITIES***Resident*

|                              |                   |
|------------------------------|-------------------|
| Carl William Blegen.....     | Cincinnati, Ohio  |
| Howard Mumford Jones.....    | Cambridge, Mass.  |
| Alfred Louis Kroeber.....    | Berkeley, Calif.  |
| Lewis Mumford.....           | Amenia, N. Y.     |
| Marjorie Hope Nicolson.....  | New York, N. Y.   |
| Arthur Darby Nock.....       | Cambridge, Mass.  |
| Ephraim Avigdor Speiser..... | Philadelphia, Pa. |

*Foreign*

|                            |                 |
|----------------------------|-----------------|
| Harold Idris Bell.....     | London, England |
| Arnold Joseph Toynbee..... | London, England |

**COUNCIL NOMINEES**

|                                |                   |
|--------------------------------|-------------------|
| Andrew Ellicott Douglass.....  | Tucson, Ariz.     |
| George William McClelland..... | Philadelphia, Pa. |

## MEMBERS DECEASED DURING 1941

|                                                     | Date of election |
|-----------------------------------------------------|------------------|
| David Hilt Tennent, January 14, aet. 67 .....       | 1938             |
| Lewis B. Stillwell, January 19, aet. 77 .....       | 1898             |
| J. Rodman Paul, January 27, aet. 88 .....           | 1899             |
| Charles R. Lanman, February 20, aet. 90 .....       | 1906             |
| Dayton C. Miller, February 22, aet. 74 .....        | 1919             |
| Worthington C. Ford, March 7, aet. 83 .....         | 1922             |
| Josiah H. Penniman, April 10, aet. 72 .....         | 1901             |
| Annie J. Cannon, April 13, aet. 77 .....            | 1925             |
| Henry Osborn Taylor, April 13, aet. 84 .....        | 1926             |
| Josiah Charles, Lord Stamp, April 17, aet. 60 ..... | 1940             |
| Preserved Smith, May 15, aet. 60 .....              | 1937             |
| William Guggenheim, June 27, aet. 72 .....          | 1930             |
| Sir Arthur John Evans, July 11, aet. 90 .....       | 1913             |
| George E. Coghill, July 23, aet. 69 .....           | 1935             |
| J. P. Crozer Griffith, July 28, aet. 85 .....       | 1907             |
| Hans Spemann, September 12, aet. 72 .....           | 1937             |
| Charles Downer Hazen, September 19, aet. 73 .....   | 1923             |
| William LeRoy Emmet, September 26, aet. 82 .....    | 1898             |
| John Stanley Plaskett, October 17, aet. 75 .....    | 1930             |
| William Albert Noyes, October 24, aet. 84 .....     | 1914             |
| Emile Picard, December 12, aet. 85 .....            | 1910             |
| Tullio Levi-Civita, December 29, aet. 68 .....      | 1940             |

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Harold William Vazeille Temperley, July 11, 1939, aet. 60 .. 1938  
 Josef Hofrat Szombathy \* ..... 1886

### TABLE OF TOTALS

|                            | Resident Members | Foreign Members |
|----------------------------|------------------|-----------------|
| December 31, 1940.....     | 437              | 44              |
| Elected during 1941 .....  | 30               | 8               |
| Deceased during 1941 ..... | 16               | 6               |
| Reported deceased.....     |                  | 1               |
| December 31, 1941 .....    | 451              | 45              |

\* Reported deceased but no definite record received by the Society.

## XI

### OBITUARY NOTICES

ANNIE J. CANNON

(1863–1941)

Dr. Annie J. Cannon was born in Dover, Delaware, on December 11, 1863, and died in Cambridge, Massachusetts, where she had resided for the last forty-four years of her life, on April 13, 1941. Her official position at the Harvard Observatory was William Cranch Bond Astronomer and Curator of the Photographic Collection. Her unofficial position was dean of women astronomers of the world and a leading and most honored woman scientist.

Miss Cannon graduated from Wellesley in 1884, received an M.A. degree from Wellesley in 1907, and held honorary degrees from the University of Delaware, Wellesley College, Mount Holyoke College, Oglethorpe University, Groningen, and Oxford. She was one of the four women members of the American Philosophical Society (elected April 25, 1925), an honorary member of the Royal Astronomical Society, a holder of the Draper Medal of the National Academy of Sciences and of the Ellen Richards Prize.

Her contributions include scores of technical papers, chiefly in the publications of the Harvard Observatory. Most of her early work dealt with variable stars and since 1900 she maintained the principal card-catalogue bibliography in the Western Hemisphere of variable stars and related subjects. Her greatest contributions are in the field of stellar classification. She developed the Harvard system, and classified about half a million stars. Of these 225,300 are in the famous Henry Draper Catalogue, about fifty thousand in the Henry Draper Extension, and another hundred thousand, unpublished at the time of her death, will appear within a year in a special memorial volume.

The following paragraphs are quoted with slight abbreviations from an appreciation read on the occasion of the memorial services at Harvard University.

Universally acknowledged as authority on the spectral classification of the stars, she built for the future more than for her contemporaries. Her forty years of devotion to one field of science enabled her to erect a scientific castle in which man's imagination long can dwell—a structure that probably will never be duplicated in kind or extent by a single individual.

In some ways Miss Cannon's great catalogues of the spectra of stars represent not only her devoted service to science and to man's intellectual yearnings, but also her service to the stars themselves. It is not given to many to serve as she did as the personal ambassador for hundreds of thousands of individual stars—to represent such a great portion of Nature's realm, filled with its inanimate but nevertheless throbbing starlife.

Though rigorously scientific in her attitude toward her analyses of stellar spectra and toward the surveying of the skies, nevertheless Miss Cannon had a personal friendly interest in these remote gigantic gaseous spheres, which came before her vision as images on photographic plates. She did not like to have a star left out of her catalogue, with its spectrum, its temperature, its composition unrecorded for man's study, just because the spectral image on her photograph was defective, or was confused by neighboring stars. To such objects, to such underprivileged stars, her natural sympathy seemed to go out, with the result that more photographs were demanded, more efforts made to give all a fair and equal treatment. She was indeed their faithful representative.

Miss Cannon's great catalogues are frequently referred to as the bible of modern astronomy; and these massive tables do have the appropriate inspiration to justify that naming, and the power to guide the seeker after universal truth.

In the past two or three decades many astronomers have come to the Harvard Observatory to learn Miss Cannon's methods; not so much because the procedures are complicated; not so much that various criteria, different from Miss Cannon's methods, could not be set up and used constructively; but because, by common consent, it is best for anyone who classifies the spectra of faint stars to be standardized against Miss Cannon.

Less distinctly, perhaps, but more humanly, another phase of Miss Cannon's personality will long live in America. She must be classed among a group of pioneer women scientists. Most of her fellow pioneers were largely engaged in educational projects; she worked on the creative side of the great process of understanding. Her persistent activity has been a guiding light to women scholars. Her success has been their inspiration.

It may be written down sometime that great as has been Miss Cannon's scientific contribution, her highest distinction has been her personal example. For to both men and women colleagues her diligence, her quiet and cheerful excitement about her work, her remarkable faithfulness, and her loyalty to her science and to the

stars, have been spiritual catalysts. Certainly with such an example we cannot permit to flag our own excitement and our own endeavors.

But to many of her friends here, and to countless others in America and abroad, it is Miss Cannon the rare being, replete with human interest, that will be recalled with reminiscent pleasure, and whose passing will be mourned as a serious personal loss.

Miss Cannon loved little children with all their experimentation with a developing world; she admired school boys, and young men and women, both when they were seriously playing and when playfully working; she was deeply interested in growing families and the human perturbations of parenthood. Elderly people appealed to her greatly, and she was a most devoted friend, throughout the last years of her life, to those who had grown old along with her. In other words, from the cradle to the fourth score year, at every stage, she was intensely interested in humanity; and without exception the individuals of all the stages responded to Miss Cannon's personality. A children's party at Star Cottage, a Class Reunion at Wellesley, a meeting of the International Astronomical Union, a dinner of the American Philosophical Society—all these found Miss Cannon alive with interest, and found her making her unique contribution of vibrant personal charm.

As a pure scientist, as an inspiring leader of women scholars, as a human companion, Miss Annie Cannon led a long and happy and useful life.

In addition to the Memorial Volume containing her unpublished work, Miss Cannon's life and scientific work will be commemorated, according to present plans, by other memorials. There will be a memorial room at the Harvard Observatory, appropriately decorated; an endowment for the continuation of the card catalogue of variable stars; and possibly one or more research fellowships and a bureau for the extension of her work on spectrum classification and galactic analysis.

HARLOW SHAPLEY.

GEORGE ELLETT COGHILL<sup>1</sup>

(1872-1941)

George Ellett Coghill, born at Beaucoup, Illinois, March 17, 1872, died at Gainesville, Florida, July 23, 1941. About a year after his graduation from Brown University a chance meeting in

<sup>1</sup> This notice is reprinted with minor changes from an editorial in *The Journal of Comparative Neurology* 75, no. 2: 191-194 (Oct. 1941). The editorial was written by the undersigned and is reproduced by permission of the Wistar Institute of Anatomy, the publisher of the Journal.

the summer of 1897 with the late C. L. Herrick, then President of the Territorial University at Albuquerque, New Mexico, opened the way toward a realization of his ambition to devote himself to the study of the nervous system as a biological approach to psychology and a naturalistic philosophy. The three years of apprenticeship with primitive facilities in New Mexico (during which he earned the M.S. degree and attained the rank of Assistant Professor) were the seedtime of the abundant harvests which matured in unbroken series throughout the remainder of his life.

Though all of Doctor Coghill's published research deals with strictly biological subjects, these were attacked with a breadth of view and an originality of method which yield clear evidence that his initial interest in the philosophical implications never waned. Unfortunately little of his psychological and philosophical thinking came to expression in print. His conversations and brief comments scattered through his later publications show that his grasp of the psychological and philosophical significance of the mass of factual data which he had accumulated so industriously and scrupulously was clear, incisive and profound. Among these publications special mention should be made of the lectures on "Anatomy and the problem of behavior" delivered in London (Cambridge University Press, 1929), the presidential address, before the American Association of Anatomists, "The neuro-embryologic study of behavior: principles, perspective and aim" (*Science*, vol. 78, 1933), "Integration and motivation of behavior as problems of growth" (*J. Genetic Psychol.*, vol. 48, 1936), and "Space-time as a pattern of psycho-organismal mentation" (*Am. J. Psychol.*, vol. 51, 1938).

From New Mexico he returned to his Alma Mater, receiving the Ph.D. degree from Brown University in 1902. Then followed several college appointments (Pacific University, Oregon, 1902-1906; Willamette University, Oregon, 1906-1907; Denison University, Ohio, 1907-1913), and in 1913 he went to the State University of Kansas as Associate Professor of Anatomy. He became Professor in 1916 and Head of the Department and Secretary of the School of Medicine in 1918. In 1925 he moved to The Wistar Institute of Anatomy and Biology at Philadelphia, where he held the rank of Professor of Comparative Anatomy until 1936. He was elected a member of the American Philosophical Society on April 19, 1935.

Despite serious impairment of health of varying severity, his research activity continued until his death. He acquired a small tract of land adjoining the State University campus at Gainesville, Florida, and here he lived in retirement after 1936, devoting himself to his program of research as strength permitted.

Doctor Coghill's first neurological paper (with C. L. Herrick) appeared in volume 8 (July, 1898) of the *Journal of Comparative Neurology*, less than a year after he began his apprenticeship, starting from scratch with no previous biological training. His doctor's dissertation on "The cranial nerves of *Amblystoma tigrinum*" appeared in volume 12 ('02), and beginning with volume 14 ('04) he was connected with this *Journal* as an editorial collaborator. He was managing editor from 1927 to 1933, when failing health necessitated relief from these exacting duties, though he continued to serve as an active member of the editorial board.

Rarely do we see a program of integrated research carried through with so definite objective, so scrupulous and critical fidelity to exacting standards of factual evidence, so clear insight into the meaning of the facts observed, and so important results of fundamental significance for an understanding of the organization and operation of the animal body. This program from its inception was his own individual enterprise, in conception, method and interpretation. Most of the factual evidence so far published is in the twelve parts of his "Correlated anatomical and physiological studies of the growth of the nervous system of *Amphibia*" ('14 to '36). Whether the large collection of unpublished data can be collated for publication cannot now be told.

It may safely be said that this series of studies and the few accompanying published lectures and special papers comprise one of the major American contributions to fundamental biology. This is the first and so far the most complete account of the actual existing relationship between the progressive differentiation of bodily structure and the operations of that structure as manifested in overt behavior. The accuracy of the recorded observations has been checked by numerous other observers, and the theoretic conclusions drawn from them seem to be securely established for the material studied. How far these generalizations may be extended beyond the *Amphibia* to animals of different structural organization and developmental history and what modifications of them

may be found in these other animals are questions which require further investigation.

This achievement is Doctor Coghill's imperishable memorial. His indomitable perseverance and industry and his critical acumen led him from the start to distrust all conventional dogmas, to devise new methods of work, and in the end to follow his evidence through to the formulation of an organismic conception which emphasizes the essential integrity of the living body. This is his greatest contribution—the demonstration of the unity of the organism, the place of "partial patterns" of behavior in the "total pattern," the dominance of the total pattern throughout life, and some details of the structural organization that performs both the integrative and the analytic functions.

C. JUDSON HERRICK.

### WILLIAM LEROY EMMET

(1859–1941)

More efficient use of power—this expresses, in a few words, the achievements of William LeRoy Emmet. But the means by which he attained these results, so significant in the history of engineering, would take volumes to relate. In a foreword to Emmet's charmingly naive *Autobiography of an Inventor* (1930 and 1940), Edwin W. Rice, Jr., President of the General Electric Company from 1913 to 1922, summarized his contributions under four categories.

"The first," said Rice, "embraced contributions to many types of apparatus and methods of distribution which have been extensively used for many years in the central station electric industry. The second covered steam turbine electric apparatus, which largely through his designs and tireless energy was within a few years brought from small beginnings to a place of dominating importance in the electrical industry. His third related to the electrical propulsion of ships, and this was a long and difficult task. It was fitting that his first successful demonstration of the value of this method of propulsion was made in its application to ships of the United States Navy. It is my belief that the Navy owes a great debt to the persevering efforts as well as the technical skill, of Mr. Emmet. Mr. Emmet's fourth, and most difficult and prolonged task, has been the invention, design and development of the mercury vapor power system which makes possible the production of more power from coal than has ever before been accomplished."



Emmet himself wrote, in the *Autobiography*, "There is one merit that I can with justice claim for my career, and that is definiteness of purpose backed by a dogged perseverance." Perhaps this doggedness was a result of his Irish ancestry. He was born at Pelham, N. Y., July 19, 1859, the son of William Jenkins and Julia Colt (Pierson) Emmet. His great-grandfather was Thomas Addis Emmet, first of the family to come to America. Thomas, himself a distinguished Irish patriot and leader in the Society of United Irishmen in 1789, was the elder brother of that idol of the Irish race, Robert Emmet, who was executed in Dublin in 1803.

After his elementary education in the schools of Canada, New York, William LeRoy Emmet entered the United States Naval Academy. He was graduated in 1881, and served as cadet midshipman on the U. S. S. *Essex*. This was before steam had completely replaced wind as a source of marine power. The *Essex* was a small ship, barque rigged, and provided with only a moderate degree of rather antiquated engine power. "We cruised under sail most of the time," he related, "and when we steamed we used salt water in the boilers and pumped and blew holding the water to a certain degree of salinity with a salinometer." Perhaps his personal experience with such crude equipment led to his own later contributions to marine engineering.

However, his nature, which he admits to have been "somewhat rebellious," did not seem suited to a naval career. In 1883 he returned to the Naval Academy for the final examinations. Though he passed, he left the Navy with an honorable discharge. In 1898, however, he was to re-enter the naval service, with the rank of junior lieutenant, and to serve as navigator on the U. S. S. *Justin* during the Spanish-American War.

From 1883 came a series of jobs in New York City. He made tracings for a time in an architect's office; then he worked as a clerk and salesman for a firm that sold patent lathing. Next came some months as a clerk in the Car Accountant's Office of the Erie Railroad. His first electrical work came when he obtained a minor post, at a weekly wage of seven dollars, with the United States Illuminating Company, a small concern operating arc and incandescent lights from two small stations. Though his hours were from seven in the morning to nine at night, the work was easy enough for him to do considerable reading and study.

During this time Frank J. Sprague, whom Emmet had known slightly while both were at Annapolis, was making history with his electric railway at Richmond. In 1887 Emmet applied to him for a job. Turned down, he went back six months later and was this time accepted, so he entered the employ of the Sprague Electric Railway and Motor Company. Later he went to the Buffalo Railway Company as electrical engineer and soon afterwards accepted a position with the Edison General Electric Company, in the Chicago District. In 1892 the Edison General Electric Company combined with the Thomson-Houston Company to form the General Electric Company, and then Emmet came to Schenectady.

It was about this time that the project of harnessing Niagara Falls to generate power was started. To General Electric came the task of providing for the transmission of thousands of horsepower of electrical energy from the Falls to Buffalo—the unheard-of distance of twenty-six miles! The work was placed in Emmet's charge, and a few years later the line was in operation.

From the Niagara generators came electricity at a potential of 2000 volts, two-phase. Transformers stepped it up to 10,000 volts, and changed it to three-phase for the transmission. At Buffalo it was stepped down again, and used to run street cars and factory motors, to light the city and serve other purposes. Around the great source of power at Niagara began to spring up other factories, heavy users of electrical power and in many of these Emmet was responsible for the special equipment that had to be installed. It was his work at Niagara, he maintained, that led to his election as a member of the American Philosophical Society in 1898.

The steam turbine, invented by Charles G. Curtis, had been experimented with for several years, before 1900, when Emmet took up its study. Though some engineers had reported adversely upon it, he recognized its capabilities, especially the advantages over reciprocating engines in simplicity and economy of manufacture. Two turbines, one of 500 kw., the other of 1500 kw., were planned. Curtis designed the nozzles and buckets, which were to revolve at 1800 r.p.m.; Emmet the general mechanical construction and the arrangement of the parts. He also, in collaboration with H. G. Reist, designed the generator.

These turbines, with the shafts horizontal, were built and successfully operated. Then Emmet took the courageous step of in-

creasing the power to 5000 kw., and at the same time radically altering the arrangement by placing the shaft in a vertical position. Three turbines of this type, of 500 kw. and 1500 kw. in addition to the 5000 kw. unit, were in the shop simultaneously. First finished was the 500, which was highly successful. Then, after an epic struggle to complete it, for use in the Fiske Street Station of the Commonwealth Edison Company of Chicago, the 5000 kw. machine went into service in March, 1903, and it too proved that Emmet had been right. This was the start of a large and successful industry which far outstripped other turbine activities in the electrical field. The success of this campaign is credited to Emmet's initiative, and to his specific ideas and experimentation.

Then came the work on electrical ship propulsion. By 1908 development of the turbine generator had reached a point where, in Emmet's opinion, it could be applied to ships, particularly naval vessels, for which it gave many advantages. Several years of educational work were needed before, in 1913, the Navy Department was induced to try it in the collier *Jupiter*. Though this type was not particularly suited to the demonstration, the system proved highly successful. The propellers are driven by electric motors, which in turn receive their power in the form of electrical current from the generators. Later the *Jupiter* was converted into the U. S. S. *Langley*, the Navy's first aircraft carrier. Electric propulsion was adopted for the carriers *Saratoga* and *Lexington*, for other large war ships, including the *New Mexico*, and for the French liner *Normandie*, which was taken over by the U. S. Navy as the ill-fated U.S.S. *Lafayette*.

Emmet also recognized the possibility of high speed gearing for ship propulsion, and for other applications in the electrical field. Under his direction, and largely through his own designing, the Alquist method of gearing was developed. These earlier studies made it possible for the General Electric Company, during the First World War, to produce geared turbine machinery for three hundred merchant ships and fifty destroyers.

Emmet's last great field of endeavor was the mercury vapor process of power production which bears his name. In general a thermodynamic cycle is more efficient the greater the temperature range through which it operates. However, there is a practical limit to the maximum economy that can be attained by superheating steam above the boiling point. Better is a binary cycle, in

which two vapors are used, one with a boiling point considerably higher than the other. In 1913 Emmet introduced his first mercury boiler, an experimental model. Ten years later the first commercial installation, to deliver 1800 kw., was made at the Dutch Point Station of the Hartford Electric Light Company. Then came a 10,000 kw. plant for the same company, followed, in 1932, by two 20,000 kw. units, one for the Kearny Station of the Public Service Electric and Gas Company of New Jersey, and the other for the Schenectady Works Station of the General Electric Company. In all of these mercury vapor drives a simple turbine; then, in condensing, vaporizes water to steam. This is superheated as it passes through the exhaust gases from the mercury boiler, and drives a steam turbine of the usual type. These plants have proved highly efficient, and their principles may be applied to marine and rail propulsion as well.

Though he had many patents to his credit, Emmet's most brilliant accomplishments were more as an institutor of new ideas than as inventor. His perseverance, in continually pushing a new idea until it was accepted, was considered by his associates as one of his outstanding qualities. Thomas A. Edison, who from his own experience could well appreciate this, wrote him in 1926 in regard to one of his new inventions: "The worst is to come, for it takes about seven years to convert the average man to the acceptance of a solved problem."

His qualifications especially fitted him for finding new scope for the talent and facilities of his Company's organization. Continually, in articles and speeches, he urged engineers to obtain new knowledge by experiment rather than depending solely on books. "There is only one sure way to get at the exact knowledge needed for new undertakings, namely experimentation," he wrote. "The all-important word to the engineer is 'why,' and it is astonishing how few people ever think it worthwhile to trouble themselves about that question, or to make much effort to find out whether the answers suggested will bear analysis. The good engineer must know the reason why."

In addition to his *Autobiography*, he wrote *Alternating Current Wiring and Distribution* (1894), and numerous important papers presented before engineering societies. He was a member of the American Institute of Electrical Engineers, which he served as vice-president, of the American Society of Mechanical Engineers, of

the Society of Naval Architects and Marine Engineers and of the National Academy of Sciences. His clubs were the University and the Engineers, of New York, and the Mohawk and the Mohawk Golf, of Schenectady.

In 1910 Union College gave him the degree of D.Sc., *honoris causa*, and he later received the same degree from Trinity College. He was awarded the Gold Medal of the St. Louis Exposition for the vertical shaft turbine. The Edison Medal came to him in 1909, then the Gold Medal of the San Francisco Exposition for electric ship propulsion, and the Elliott Cresson Medal of the Franklin Institute in 1920. The American Society of Mechanical Engineers gave him their Gold Medal, while in 1938 the American Society of Naval Architects and Marine Engineers honored him with the David W. Taylor Medal.

In addition to being a distinguished engineer, he was a generous and public-spirited citizen, a lover of the out-of-doors and a keen sportsman. He organized the highly successful Schenectady Curling Club and the play for the Emmet Cup is an important annual event. Though he never married, he was fond of young people, who knew him familiarly as "Uncle Bill." To his associates he was seldom "Dr. Emmet," but mostly just "Bill Emmet."

He was not the only eminent member of his family. Two of his sisters, Miss Lydia Field Emmet and Mrs. William Blanchard Rand, are well-known portrait painters. One of his nephews is Robert Emmet Sherwood, the playwright. Another nephew is Robert R. M. Emmet, a captain in the U. S. Navy. A third is Hermann L. R. Emmet, manager of the Erie, Penna., Works of the General Electric Company. It was while visiting him, on September 26, 1941, that this long and useful career ended. Bill Emmet was laid to rest, with naval honors, in the Arlington National Cemetery, in Virginia.

W. R. WHITNEY.

## SIR ARTHUR EVANS

(1851-1941)

On July 8, 1851, there was born to John Evans a son, baptized Arthur John, who was destined to bear one of the best-known names among the British archaeologists of our day. The boy's grandfather, the Reverend Doctor A. B. Evans, was the head

master of Market Bosworth grammar school, and his father's name became well known not only as a very wealthy paper maker but as the author of still valuable books on British antiquities. He was president of the British Numismatic Society for thirty-six years, ending with his death in 1908, for twenty years treasurer of the Royal Society, president of the Society of Antiquaries, and a trustee of the British Museum. The father had been knighted in 1892 and was the fourth member of his family to be admitted to the Royal Society. The boy's feet were soon on the father's path, stepping into his sire's footsteps to make a name which far outshone any other's of the family. They appear to have been a tough, long-lived lot, those Evanses, for the father, Sir John, was eighty-five years old when he died, and the son, who became Sir Arthur, had seen his ninetieth birthday before he was to go too.

Arthur Evans, the eldest boy in the family, was sent to Harrow, to Brasenose College, Oxford, where he got a First Class in Modern History, and to Göttingen—this last in those days a place where many a young man of England, and a few Americans, polished off an education begun in the universities nearer home. Those were happy days when Germans were somewhat childish but marvellously efficient in every calling where brains were required, and no one was inclined to think of their somewhat carelessly scarred faces as more than curiosities. But Arthur Evans seems to have got some strange fancies. At the age of twenty-two he was in Finland and Lapland and in the Balkans, and then one reads that until the early 'Eighties he was living at Ragusa. By the time he had barely entered his thirties he was in an Austrian prison for being mixed up in a revolution in Dalmatia. He could not have been locked up very long, but he was proud of his incarceration long after Austria had ceased to exist. Meantime, in 1878 he had married Margaret, daughter of the historian Freeman, and after her death in 1893 he never married again.

It was about this time that the eastern Mediterranean and man's first steps toward culture there began to interest him. So far most of what we read of him is of a well-to-do young Englishman playing around in politics and in anthropology—his father's calling. In 1884 he was appointed keeper of the Ashmolean Museum in Oxford, which he immediately started to revitalize. The Ashmolean was still in its first building, half emptied by the rest of the university, and the young keeper had to build it up and

erect a new building near the art gallery, largely at his own expense. Before he was finished, the gallery was part of the museum and Evans' name only second to that of Ashmole as its benefactor. For about ten years Evans was the curator in his chosen institution, writing about Illyria and Bosnia and on the coinage of Magna Graecia and the antiquities of those parts. All would have gone well enough and there would have been another of his family entered in the list of Fellows of the Royal Society anyway, when for some reason his interest in Crete began to gather momentum in the mid-'Nineties.

Probably his interest in his museum bent his thoughts, and then his footsteps, in the direction of this little-known Greek island. Crete had been a sadly mismanaged part of the Turkish Empire—a province more than half Christian always, but with a large Muslim population. Twenty years before this there had been a movement to join Greece, and in 1896 these fires broke out and blazed from end to end of the long, thin island. It took two years more for Crete to get rid of the last of the Turkish soldiers, however, and then began an unsettled period under the Powers until 1906.

His first visit to Crete was in 1893 when Evans wanted to see if the land could throw any light on the antiquities lately found on the mainland by Schliemann. Inscribed seals could be picked up almost everywhere, in the ground and in the hands of natives. *Cretan Pictographs and Prae-Phoenician Script*, published in 1896, seems to have been his first written work on the subject, but actual excavation in Crete was impossible until the Turkish war was over. Then in 1900 he began to dig on a large scale, continued until 1908 on the same scale, and only finished really about 1935. These excavations gave to archaeology an entirely new picture of ancient Greece, going back 2000 years B.C., and making the names of Crete and Evans synonymous for most of us. The earliest dawn of Hellenic culture had been Schliemann's Mycenae. Evans supplied the parentage of Schliemann's finds.

At first he wrote and published a yearly report in the *Annual of the British School at Athens*, but the deeper he went into the unknown past the more impossible became such reports each year, and he gave up that scheme. His plan was to write a series of monographs, and to the first he gave the somewhat fanciful—but characteristically intelligible—name, *Scripta Minoa*, in 1909. In

1914 he had another volume ready when the catastrophe of the first world war occurred, and during those years of enforced waiting he entirely re-wrote what he had already done.

The first volume of *The Palace of Minos*—again with the fanciful name of the Minatour—appeared in 1921 and the fourth in 1935. The first showed a tremendous amount of originality. Up to then no one of us had realized that a very cultivated people had lived and died for centuries on the Island of Crete and that for thousands of years every trace of them was buried under Cretan pastureland. It is strange that Evans, a Briton, was destined to unearth a people who had every trait of his own race, had been important in their little island just about as long, and yet had been sunk without a trace time out of mind.

For nearly half a century he lived and dreamed of it. Seven years after the first came the second volume, unfortunately promising to be so thick that its author had it bound in two parts and put nothing on the backs to show that fact. The first volume had taken years to see the light, but this one described what had been done from the end of the war to 1928. Crete became more and more obviously part of the Mediterranean world, and the third and fourth volumes of Knossos put the seal of Evans' personality on the island. I have a suspicion that our successors in archaeology will tear up much that he did, but after all he founded the subject and was its chief exponent for nearly fifty years, although there were innumerable others throughout that half century who labored hard and who labored well. For the work at Knossos Evans had gathered about himself a group of whom the Gillérons, both father and son, are known everywhere for the replicas of his finds made for the museums of the world.

In the course of time Evans was knighted, and his government put its seal of approval on one of the great men of the profession of archaeology. His seasons in Crete became progressively shorter as he grew older and his interests became more and more diffused. But one may well doubt whether he ever will be robbed of the names he gave "The Queen's Megaron," "The Court of the Distaffs," or any other part of the palace, for the latter will soon fall in the frequently recurring earthquakes but his books are scattered in libraries everywhere. Honors came thick and fast to Sir Arthur Evans, F.R.S. He was elected a member of the American Philosophical Society on April 19, 1913. Throughout it all he



remained a simple old country gentleman with a delightful sense of humor, as he showed me when I was taken to see him at Boar's Hill, near Oxford. That was obvious when he showed me a lovely little Cretan ivory statuette he had no business to have smuggled out of Crete; it wasn't so obvious when I went puffing up the steep sides of the artificial hill he had put up on his naturally nearly flat estate.

Sir Arthur was wonderfully himself to the last, working and very much alive to things and very resolute to see his ninetieth birthday. Those who have looked over his papers say many of them show a surprising competency, though they are a little behind the times now, but they were written when they were very much in front of them. He had a marvellous memory, a colossal mass of facts at his finger ends, and a great power of controlling disordered data. His wide tables seemed to be a hopeless heap of untidy papers, but if he wanted one, he rooted about among them and never failed to find what he was looking for. He was generally, if not always, master of a difficult situation, as for example when on leaving Crete in early days he was unexpectedly challenged on the quay by customs officials. Aware that he had in his satchel a statuette which he had just purchased and that his reputation for rectitude was about to be lost just when he needed an unstained one, he suddenly put his hand into the bag and chucked the thing far into the harbor. Once the cry that a gold statue of untold value had been thrown away was heard, every boat was out dredging the bottom. But they could neither find nor prove anything. He used to tell the tale of the factotum of a certain museum who was dismissed because he had made forgeries to sell to tourists and several were bought by the museum itself. The curator got him to point them out finally and removed them, but he showed them to Sir Arthur and said that of course he could not exhibit them any longer. Evans looked at them and said: "All right, but I will give you £100 for that one on the chance"—and it was not such a bad gamble after all.

On his ninetieth birthday Sir Arthur received as much acclaim as was possible in another war with the Germany which had by now become his country's perpetual enemy, and three days later, on July 11, 1941, he died.

H. E. WINLOCK.

## JOHN FINLEY

(1863-1940)

John Huston Finley was born at Grand Ridge, Illinois, October 19, 1863, and died March 7, 1940. He was graduated from Knox College in 1887; at Johns Hopkins University he pursued graduate studies, frequently catching up with them; and while still a young man showed capacities for leadership. He was elected to the National Institute of Arts and Letters in 1908 and to the American Academy in 1927. He was the recipient of many honorary degrees and decorated by many foreign societies. And he was a great-hearted, genial, jovial man, intensely loved by those who knew him well.

We all forgot the positions of honor and distinction that he held, because he was so entirely natural and unaffected that he seemed to have forgotten them himself. As a matter of fact, he was President of that admirable institution of learning, Knox College, and if what I remember about the history of athletics there is true, it would please President Hutchins.

I read somewhere that Knox College lost its main football game twenty-five consecutive years, during which period the enrollment of students increased annually.

Later Dr. Finley was a member of the faculty at Princeton, his frequent method of transport between Princeton and New York being on foot. He was President of the College of the City of New York and later head of the State Board of Education; but although he adorned all these places of authority, he was happiest after he had joined the editorial board of the *New York Times* where he was successively assistant editor, editor-in-chief, and editor emeritus. He was elected a member of the American Philosophical Society in 1919.

It was a delight to meet him and Mr. Ochs and young Charles Merz and John Kieran and other leading lights of the great newspaper. At one of the daily luncheons held by the staff in the Times Annex, Dr. Finley was evidently so happy in his work, so full of the consciousness that he was equal to it (a totally different thing from conceit) that it was a delight to be with him.

And although he held so many positions where he was "the chief," he was never a personage, he was always a person—a tre-

mendous personality. One felt his vitality. He had the mind of a scholar and the heart of a boy.

Like the late Leslie Stephen, whom he resembled in his love of learning and of the humanities, he was enormously fond of walking. He greatly preferred walking to playing games. I have never known anyone except Edward Payson Weston who walked so many miles. I have spoken of his walking between New York and Princeton; that seemed nothing remarkable to him. For he literally took it in his stride. He took tremendous walks all around the country; and whenever he crossed the ocean, which was rather often, he walked twenty-five miles every day on deck.

He was a firm believer in Greek and Latin as the best foundation for scholarship and for the good life; quotations from the classics came naturally from him. He was brought up on the Bible; he loved it; it was his daily food. Without being in the least degree sanctimonious, one felt his invincible integrity, his love of the best in character and social intercourse, and although a natural leader, everyone instantly felt at ease with him because he was so full of human kindness.

He loved good stories, was full of fun, and his laughter was antiseptic. He was affectionate; for many years all his letters to me were signed John Quill, with a pen picture of the quill and not the flower. He was a good man and is now with God.

WILLIAM LYON PHELPS.

### JOHN P. CROZER GRIFFITH

(1856-1941)

John P. Crozer Griffith, the son of Benjamin Griffith and his wife Elisabeth Crozer, was born in Philadelphia, January 5, 1856. In 1877 he graduated with the degree of A.B. at the University of Pennsylvania. In 1881 he graduated from the medical department, and also received the degree of Ph.D. from the same institution. From an early period in his professional career Dr. Griffith specialized in the diseases of children. From 1891 to 1913 he was Clinical Professor of Diseases of Children, and from 1913 Professor of Pediatrics in the University of Pennsylvania, and was also physician to the Children's Hospital, St. Christopher's Hospital for Children and consultant in Pediatrics to the Abington Memorial,

Jewish and Misericordia Hospitals. He was a member of many local, state and national medical societies.

Dr. Griffith was a frequent contributor to periodical medical literature, and the author of several successful books on diseases of children, two of which, *The Care of the Baby*, 1895, and *The Diseases of Infants and Children*, 1919, were very successful and went through several editions. In addition to his professional activities Dr. Griffith took a deep interest in the affairs of the Baptist Church. He was President of the Board of Trustees of the Baptist Orphanage, and the Crozer Theological Seminary, and Chairman of the Board of Managers of the American Baptist Publication Society.

Dr. Griffith married Julia E. Jenks in 1882. There was no issue from the marriage.

Dr. Griffith was elected a member of the American Philosophical Society, April 20, 1907. His death occurred July 28, 1941, at his home in Philadelphia.

FRANCIS R. PACKARD.

### WILLIAM GUGGENHEIM

(1868-1941)

William Guggenheim, capitalist and publisher, died June 28, 1941, at New York City. He was born in Philadelphia, November 6, 1868, the son of Meyer and Barbara Myers Guggenheim. Educated in the public schools of the city, he was graduated by the University of Pennsylvania in 1889 with the degree of Bachelor of Science. His father's large mining interests suggested to him the desirability of fitting himself to engage in them. For this reason he abandoned an intended course in the law and devoted himself to science, with special attention to chemistry and metallurgy. He was appointed superintendent of the Philadelphia Smelting and Refining Company of Pueblo, Colorado, and for the next ten years was in the management of the various mining and smelting interests of his father in Mexico. He rose to be an officer in several of these companies and constructed lead and copper smelting plants at Monterey and Aguas Calientes. In 1901 the various companies in which his father was interested were merged in the one corporation and Mr. Guggenheim retired from active direction.

He was married to Grace Brown in Illinois and in 1904 to Aimee Steinberger in New York; the latter and one son survive him.

Active in alumni affairs of the University of Pennsylvania and in societies dedicated to the memory of its founder, Benjamin Franklin, he became honorary president of the International Benjamin Franklin Society, and a member of the American Chamber of Commerce in France, Museum of the City of New York, American Museum of Natural History, Metropolitan Museum of Art, Academy of Political and Social Science, American Philosophical Society (elected April 25, 1930), and the General Alumni Society of the University of Pennsylvania.

THOMAS S. GATES.

### EDWARD STEPHEN HARKNESS

(1874-1940)

Edward Stephen Harkness, son of Stephen V. and Anna M. Richardson Harkness, was born January 22, 1874, in Cleveland, Ohio, and died January 29, 1940, in New York City. He was the youngest of three children and, owing in part no doubt to his father's death during his boyhood in 1888, his relations to his mother, for whom he cherished the deepest affection and respect, were unusually intimate.

From 1880 to 1889 he attended private schools in Cleveland. In the latter year he went to St. Paul's School in Concord, New Hampshire, from which he was graduated in 1893. He entered Yale at once and received his A.B. degree in 1897. After graduation he returned to New York and lived in an apartment with his mother. During this period he traveled extensively, among other trips making voyages to Hawaii and Japan. On November 5, 1904, he married Mary Stillman, of Brooklyn, who survives him. In her companionship he found the great happiness of his life.

When he came of age he was at once confronted with the pre-occupying task of managing a portion of the great estate which had been left by his father and of determining, in cooperation with his wise and generous mother and with his elder brother, Charles W. Harkness, who had been made administrator of his father's property, what principles should be adopted in handling the vast income which ultimately was to come into his hands. His mother's influence was unquestionably of decisive importance in leading him from the first and throughout his life to feel a deep obligation so to ad-

minister his property as to benefit mankind. Mr. Charles Harkness died in 1916, leaving his brother Edward all of his oil stocks, and Mrs. Stephen Harkness died in 1926 providing in her will for many generous gifts and leaving him her entire residual estate.

In both school and college he was a quiet, modest lad who met his academic obligations conscientiously and was held in warm regard by the small group of friends who knew him well. He was temperamentally shy, as well as modest, and shunned with genuine dismay all public recognition of his philanthropies. As President of Yale University, I repeatedly failed in the effort to gain his consent for appropriate recognition by his Alma Mater of his innumerable benefactions to her, and only at a relatively late date could he be induced to receive an honorary degree at her hands. She bestowed upon him the degree of Master of Arts in 1925. Her higher honors he steadfastly declined. He was later persuaded to accept the LL.D. from St. Andrews and from Columbia. He was elected a member of the American Philosophical Society in 1934.

In 1918 his mother founded The Commonwealth Fund with an endowment of approximately \$10,000,000 "to do something for the welfare of mankind." In the following seven years, through a series of gifts and a large legacy in her will, she increased the capital of the Fund to \$38,638,464. Mr. Harkness served from the beginning as President of the Fund, giving much of his time to the consideration of its problems and in 1937, by two gifts, he increased the endowment by \$8,000,000.

As is well known, this Foundation has contributed generously to medical research and education, has been active in the field of psychiatry and mental hygiene, has erected hospitals in rural districts and, carrying out a cherished plan devised by Mr. Harkness, has provided Fellowships for a great many British students who have been thus enabled to study in American universities. All these projects had his close thought and study, for despite the incessant solicitation to which, like other men of wealth, he was subjected, he never made important gifts without the most thorough examination of the merits of the case.

To recount Mr. Harkness' gifts to innumerable worthy causes is to use no adequate measure of his contribution to his time, but it does afford an impressive indication of the range of his interests. A complete list it would be impossible to offer, but a few of the more striking examples may well be cited.

Believing firmly in the value of education as a sound foundation for life, he made many contributions to schools, colleges and universities—among them gifts to Columbia, Johns Hopkins, the California Institute of Technology, Swarthmore, Colgate, Union Theological Seminary, St. Andrews (Scotland), Yale-in-China and, on the largest scale of all, to Yale and to Harvard.

He had a sincere interest in the education of women which led him to make important gifts to Mount Holyoke, to Wellesley, to Vassar, and to Sarah Lawrence College.

His interest in the education of colored people was reflected in gifts to Atlanta University, to Fisk, to Tuskegee and to Hampton Institute.

He had a deep concern for the education of boys, as is evidenced in his gifts to many preparatory schools, among them Andover, Exeter, Lawrenceville, Deerfield, Taft and St. Paul's. He believed that many boys require far more personal, individual understanding and assistance than that customarily received in the large classes of the average secondary schools, and his notable gifts to Exeter and to Lawrenceville were directly dictated by his interest in the plan to furnish adequate personnel and proper physical facilities to permit the use of very small classes and much more intimate contact between teacher and pupil. The success of these ventures was justly a source of great satisfaction to him.

He had a keen interest in beauty and in the arts, which fact was strikingly illustrated in his gift to Yale of the Gallery of Fine Arts and the University Theatre. He also gave the funds to establish the Department of Drama, which made it possible to call to Yale George Pierce Baker from Harvard, where his "47 Workshop" had long enjoyed fame as a training school for young dramatists.

He was a member of the Board of Trustees of the Metropolitan Museum of Art in New York in the development of which he was much interested, and especially in the Egyptian Collections to which he gave the remarkable Carnarvon material.

It was a deep conviction of his that one of the greatest contributions which could be made to the enduring interests of humanity was represented in the combination of a great hospital with a great medical school, the two collaborating in teaching and research as well as in the alleviation of suffering. This fact explains the patient and persistent effort which he gave to bringing about the merger of the Presbyterian Hospital in New York with the Medical

School of Columbia University. The practical obstacles to be overcome in this merger were of the greatest complexity and difficulty, and repeatedly it seemed to be impossible to bring about such a unification. Mr. Harkness never became so discouraged as to abandon this plan, which happily was at last brought to completion. When this occurred, he made most generous gifts of land and buildings, including the Eye Institute and Bard Hall, a residence for medical students. He gave with his mother the Harkness Pavilion and from time to time made many lesser gifts. He was an active member of the Board of Managers of the Hospital.

He cherished a deep affection for England as our Mother Country and traveled there frequently and made gifts to various British causes. Doubtless the most notable of these was the establishment of the "Pilgrim Trust" in 1930, a fund "to promote the future well-being of Britain" and to be administered entirely by a distinguished group of British men.

For this purpose he gave two million pounds and selected as his first Board of Trustees: Lord Macmillan, Earl Baldwin, Sir James Irvine—Vice Chancellor of St. Andrews, Sir Josiah Stamp (later made Lord Stamp), and John Buchan (later made Lord Tweedsmuir).

Together with the British Fellowships provided by The Commonwealth Fund, to which reference has already been made, the Pilgrim Trust permitted Mr. Harkness to express his deep concern for promoting intimate and understanding relations between the Mother Country and our own. It was a peculiar gratification to him, partly by reason of his affectionate regard for Sir James Irvine, and partly because of his belief in the principle involved, to be able to make it possible for St. Andrews to renew its Collegiate system of residence. He also furnished the means to restore the historic Chapel of St. Salvator's College.

It is too early to hazard any estimate of the relative significance of Mr. Harkness' unceasing benefactions, but it is not impossible that the stamp which he put upon the two great universities—Harvard and Yale—by his gifts which made possible the adoption by those institutions of a Collegiate residential form of life for their students, comparable to that at Oxford and Cambridge, may have enduring consequences for more human beings than any of the others. Certainly, it will color the inner life of those institutions for generations to come. This is not the place to elaborate upon



the detail of those plans, but again, as in the case of his gifts to St. Andrews, to Exeter and to Lawrenceville, they disclose his profound confidence in the educational value of intimate human contacts in small selected groups.

Only one in close daily contact with him could write with any confidence of Mr. Harkness' inner life, but no one who met him even casually could fail to be instantly impressed by his gentle, cordial personality and one quickly came to feel the clarity of his mind and the sincerity and strength of his character. The nation has been fortunate of late years in that so many men of large means have been possessed of a deep desire to make their wealth serve humanity. Among them none has been more generous in the support of worthy enterprises, more thorough in exploring their actual merits, more tenacious and conscientious in seeking fully to accomplish the purposes for which his gifts were made, than Mr. Harkness. The country may well be proud to have bred a citizen of such nobility of spirit.

JAMES R. ANGELL.

### CHARLES ROCKWELL LANMAN

(1850-1941)

Charles Rockwell Lanman, Wales Professor of Sanskrit, Emeritus, in Harvard University, was born at Norwich, Connecticut, July 8, 1850, and died in his ninety-first year on February 20, 1941. He studied Greek under Hadley and Sanskrit under Whitney at Yale (A.B. 1871; Ph.D. 1873), and afterwards at Berlin under Weber, at Tübingen under Roth, and at Leipzig under Curtius and Leskien. In 1876, at the opening of Johns Hopkins, he was appointed one of the original Fellows of that institution, where he taught Sanskrit until in 1880 Harvard appointed him Professor of Sanskrit. He held this chair until his retirement in 1926.

He was wont to say somewhat ruefully that he had spent his life over other people's work; and it is true that what was published over his own name does not seem very extensive, considering the length of his active career. His *Noun Inflection in the Veda* (1880) testifies to a keen interest in grammar which he always retained, and is still an invaluable tool of research. His *Sanskrit Reader* (1888) has never been replaced; it is the standard

work in English for beginners in Sanskrit. He translated, and published in his own Series (about to be mentioned), the Prakrit drama *Karpūramañjarī* by Rājasekhara (1901); and completed and edited, for the same Series, Whitney's translation of the *Atharva Veda* (1905). A number of minor publications appeared in various journals.

But his greatest service to scholarship was certainly as an editor. He edited the *Transactions* of the American Philological Association for five years and the *Journal* of the American Oriental Society for fifteen. His chief monument however is the *Harvard Oriental Series*: thirty-odd stout volumes on Indological subjects, published with the income of funds left by his pupil Henry Clarke Warren.

What he put into these volumes of himself could hardly be believed, except by one who shared the experience as one of the authors. It has been said that he spent as much time over every manuscript as its author did; and this is perhaps no great exaggeration. He had a consuming passion for absolute accuracy and precision; no amount of time was too much for him to spend in checking every minutest point. He was moreover thoroughly at home in the printer's trade and profession, and used to insist on discussing minutiae of typography not only with printers, but with authors, who would usually have been glad to leave such things to him or to the printers. To publish a book in his Series was an experience often harrowing and exasperating, but also instructive. Those who lived through it were certainly the better for it. And it should be emphasized that he was at bottom one of the kindest and most generous of men.

He was also a very profound Sanskrit philologist. As his successor has recently written, "his analytical powers were much greater than his creative powers." But this fact, combined with a limitless patience and capacity for hard work, made him an unsurpassed master in the art of extracting the precise meaning from a difficult text. Some of us think this perhaps as valuable a trait, in a literary scholar, as the ability to construct brilliantly original theories.

The high regard which the scholarly world felt for him was signalized by his honorary membership in a long list of foreign societies, including the French Institute (*Académie des Inscriptions et Belles Lettres*), the Royal Asiatic Society, the Asiatic So-

ciety of Bengal, the Société Asiatique, the Academy of Social Sciences of Göttingen, the Academy of Sciences of the Institute of Bologna, the Bohemian Society of Sciences of Prague, the Russian Academy of Sciences, the Finnish-Ugrian Society, the German Oriental Society, and others. In this country, besides our Society (to which he was elected in 1906), he was a very active member of the American Academy of Arts and Sciences (Boston), and especially of the American Oriental Society and the American Philological Association.

He was the oldest, and also the last to die, of a group of some four or five American Indologists of his generation who carried on the great tradition founded by William Dwight Whitney in an earlier generation. They saw to it that this country did not lose, among the Indologists of the world, the high reputation which Whitney had won for it.

FRANKLIN EDGERTON.

### WALDEMAR LINDGREN

(1860-1939)

On the 3rd of November 1939 one of the truly great geologists not only of the United States but of the world, Waldemar Lindgren, died at his home at Brighton, Massachusetts.

Although of foreign birth and educational training, he had spent fifty-six years in the United States, becoming a naturalized citizen and filling important posts in his chosen field of geology. No one has made greater contribution to understanding of principles of mineral deposits, and his classification of ore deposits is accepted by virtually all present-day workers in geologic science.

He was of Scandinavian ancestry, having been born at Kalmar on the Baltic coast February 14, 1860. His parents were representatives of well known families of culture and long standing. Thus the boy grew to manhood surrounded by superior advantages which he appears to have made good use of from his earliest years. It is said that even at the youthful age of ten he had shown special interest in minerals and rocks which pointed the way to a long lifetime of investigation and prolific contribution in maturer years. The discovery of this bent in the lad led to well directed encouragement in the form of field trips and informative books, which together confirmed and fixed his determination at this early

age in the direction that absorbed the rest of his life. Even as a school boy he was given opportunity to visit mining districts of Sweden, Norway and Germany.

For a comprehensive account of his life and work, one should consult the account by L. C. Graton entitled "Life and Scientific Work of Waldemar Lindgren," forming an Introduction to the so-called *Lindgren Volume* published in 1933 in his honor by the American Institute of Mining and Metallurgical Engineers. There many details of his interesting career are given with appreciative discrimination. Although issued several years before his death while still engaged in almost full vigor of activity, that account covers the essential elements of his career. It is a stirring story, often recommended to beginners both for the excellence of the account and for the principles set forth, as well as the accompanying exhibit of accomplishment.

At the age of eighteen after finishing at the Gymnasium at Kalmar, young Lindgren entered the famous Royal Mining Academy at Freiberg where he came under the influence of the most eminent teachers of mineralogy and geology at that time, including Stelzner, the leading authority in Europe on ore deposits. The professors of that institution undoubtedly exerted a profound influence on his growing enthusiasm for geological science and particularly for ore deposits—the field which he himself was to enrich.

After four years of these associations under their guidance he won the degree of Mining Engineer, but continued another year occupied in graduate studies and writing on his own researches. In the meantime he had become somewhat acquainted with the reputation of America for its mineral deposits, so in 1883 he came to the United States. Here he soon secured employment as assistant on field work under exceptional conditions for one of the transcontinental railways and had the good fortune to be directed by two of the outstanding figures in American geology, Raphael Pumpelly and William Morris Davis.

Although this engagement lasted only one season, Lindgren soon picked up other engagements where he worked in laboratories and drafting rooms for commercial enterprises connected with smelting and mining. Such work was clearly not along his favorite line and he soon found an opening much more to his liking under Dr. George F. Becker of the United States Geological

Survey, who was at the height of his activity in studies of famous mining districts, among them the rich Comstock Lode of Nevada. After establishing connection with this powerful federal organization, he was occupied for many years on field assignments, most of which gave little opportunity to build an independent reputation, but did afford abundant opportunity to familiarize himself with a great variety of mineral, petrologic and structural features. He had opportunity to store and classify data and analyze processes and integrate these numerous isolated elements of observation. Possibly there was no other way to get results. But it must have been a long road to fame and high honor. Nevertheless he won both, for with this background of personal experience, with years of time to search their significance, he finally developed a philosophy of ore deposits based on geologic principles, that is everywhere recognized as a contribution of superior quality and is regarded as the most illuminating and satisfactory classification of ore forming processes ever conceived.

His field work continued for many years without widespread appreciation of its growing importance, but his writings in the course of time attracted the attention they deserved. His arguments, cautiously put forward in opposition to the prevalent philosophy of the time emphasizing the agency of meteoric waters in ore deposition, finally gained favor. The trend of the time, backed by the writings of Van Hise and the prestige of S. F. Emmons, was strongly in favor of downward moving meteoric waters. In contrast, Lindgren's experience, supported by extensive laboratory research with the aid of petrologic methods, pointed to the importance of possible deep-seated magmatic sources of ore-bearing solutions. Although Lindgren was not alone in his advocacy of the importance of igneous agencies, he was the chief and most effective advocate of this origin.

He remained with the Survey, filling one post of responsibility after another to the rank of Chief Geologist in 1911, but this was to last only a short time, for in 1912 he resigned to spend the rest of his active life in educational work and writing in his favorite specialistic field. He had had several short periods of teaching and had given special courses of instruction at different institutions, but in 1912 he was invited by the Massachusetts Institute of Technology to take charge of the Department of Geology, a position which he filled with great distinction for twenty years, con-

tinuing to the year 1933, when he retired from responsible direction and became Professor Emeritus.

In the meantime, early in his teaching service, he prepared his text entitled *Mineral Deposits*, in which he assembled in systematic form the results of his many years of observation and study. This work took high rank immediately and, with its later revisions, has become the chief text for students specializing in the subject. Graton writes of this volume that "Here was presented a classification of ore deposits more consistently genetic than any of those that prior investigators had proposed, as well as a more rational and comprehensive discussion than had previously been presented of the structural and physico-chemical controls of mineral deposition." And "The book as it now stands is a satisfaction from cover to cover and thoroughly deserves its status as the best work of its kind in any language."

Lindgren was very active in organizations devoted to research and publication. He was a leader in the Society of Economic Geologists and with a small group established in 1905 the journal known as *Economic Geology*.

He was a member of many scientific societies and organizations and had held high office in most of them; chief among them being The American Philosophical Society (elected in 1917), The National Academy of Sciences, The American Academy of Arts and Sciences, The American Institute of Mining and Metallurgical Engineers, The American Association for the Advancement of Science, The Mining and Metallurgical Society of America, The Geological Society of America, The Society of Economic Geologists, The Washington Academy of Sciences, The Geological Society of Washington, The Geological Society of Boston.

In addition he held corresponding and honorary membership in foreign scientific organizations in Canada, Stockholm, Belgium, Sweden, Leningrad and London. He was Honorary Chairman of the Sixteenth International Geological Congress held in the United States in 1933.

Princeton conferred the Honorary Doctor of Science degree on him in 1916. He was the recipient of the Penrose Gold Medal of the Society of Economic Geologists and also the medal of the Geological Society of America in 1933.

In his death geologic science lost a great leader and the most famous authority on ore deposits of his day.

CHARLES P. BERKEY.

## DAYTON C. MILLER

(1866-1941)

It was a sad day for American physics when, on February 22, 1941, death took one who for so many years had seemed necessary to complete the picture of any group where physicists were assembled.

Dayton C. Miller was born at Strongsville, Ohio, on March 13, 1866, a son of Charles W. D. and Vienna (Pomeroy) Miller. He received his Bachelor's degree at Baldwin-Wallace College in 1886 and his A.M. degree in 1889. In 1890 Princeton University conferred on him the degree of D.Sc. In 1893 he married Edith C. Easton of Princeton, New Jersey, who survives him.

D. C. Miller was appointed Professor of Natural Science at Baldwin-Wallace in 1888. In 1890 he was appointed Instructor in Mathematics and Physics, in 1893 Assistant Professor, and in 1895 Professor of Physics at the Case School of Applied Science, which position he occupied until 1936, when he became Emeritus, but Emeritus in name only, since it would be impossible to conceive of him as retiring from active service. On the occasion of his retirement, the Case School held in his honor a Convocation at which a picture of him, painted by Rolf Stoll, was unveiled and presented to the School.

Dr. Miller became a member of the Baldwin-Wallace College Board of Trustees in 1899, Secretary of the Board from 1913 to 1926, and President of the Board from 1936 until his death.

Professor Miller was primarily famous for his researches in two fields, acoustics and ether drift. In the former he enriched the subject with many valuable contributions and was the inventor of the phonodeik which he used so extensively in photographing analyses of acoustical vibrations. He was an outstanding authority on the acoustic design of auditoriums, and among those which he planned are Severance Hall, Epworth-Euclid Methodist Church, and First Church of Christ, Scientist, in Cleveland, the University of Chicago Chapel, and Chapels at Princeton and Dennison Universities, also the Chapel of Bryn Mawr College. During the last World War he made a study of the air pressure exerted around a gun when fired, and after the war he made an exhaustive series of researches on the determination of the velocity of sound in various media.

Dr. Miller had a special interest in the flute, upon which, incidentally, he himself was an able performer. With his own hands he made a golden flute in connection with his studies of the effect of material upon tone quality. He was an enthusiastic collector of flutes of all types and ages and possessed what is probably the largest collection of these instruments, with flute literature, flute music, and flute pictures, ever assembled. The catalog of Dr. Miller's books about the flute is a printed volume of 120 pages, and is the most complete of its kind in existence. The Miller collection of flute music comprises some 10,000 titles, and the collection of instruments comprises some 1400 flutes of various kinds.

Professor Miller's other great field of activity lay in the domain of ether drift, which he took up first in conjunction with the late Professor Michelson and later independently. Professor Miller's investigations in this realm have been the subject of much controversy, as has been the whole subject of ether drift experiments for more than half a century. Whatever differences of opinion there may exist as to the significance of the various experiments of different observers in this field and as to the theory of relativity which grew out of them, all must agree that the combination of all of these efforts has resulted in one of the greatest enrichments of our knowledge of basic principles in physics and of the clarification of our understanding of them which has occurred in the last half century, a half century which itself has been perhaps the most fertile period in the development of science in all time.

Prior to the investigations with which Professor Miller's name is primarily associated, he had, in 1896, after reading of the discovery of X-rays by Roentgen, become greatly interested in that subject. He set up a Crookes tube apparatus and succeeded in producing X-rays with which, in a three-hour exposure, he made a photograph of Mrs. Miller's hand. A few days later he made the first surgical X-ray photograph in America.

Not only as an investigator was Professor Miller outstanding, but also as a teacher he stood in the highest esteem. Approximately 10,000 students received instruction from him during his fifty years of service at the Case School of Applied Science. An exceptionally able manipulator, his lecture demonstrations were of outstanding excellence and none who witnessed it will ever forget his remarkable popular lecture on "The Photography and Analysis of Sound Waves."



As a boy, Miller was interested in working with his hands and in making his own toys and models. He became interested in the piccolo, and on his thirteenth birthday his father gave him a full-sized flute. Thus at a very early age was born that interest which was later to develop the magnificent collection of those instruments upon which he was so famous an authority.

Professor Miller was the recipient of numerous scientific awards including the Longstreth Medal, the Elliott Cresson Medal, and the \$1000 prize of the American Association for the Advancement of Science. In 1927 he received the Cleveland Distinguished Service Medal from the Cleveland Chamber of Commerce. He was a member of about thirty scientific societies, including the National Academy of Sciences and the American Philosophical Society (elected in 1919). He served as President of the American Physical Society and of the American Acoustical Society. He was also for some time Chairman of the Division of Physics of the National Research Council.

In 1924, Miami University conferred on him the honorary degree of Doctor of Science, and Dartmouth College and Western Reserve University honored him in similar fashion in 1927. In 1933 Baldwin-Wallace College conferred on him the degree of LL.D. His last honorary degree was a Doctor of Engineering from Case School of Applied Science, conferred in 1936.

Professor Miller was a regular attendant at all important scientific meetings. He was typical of that group of American physicists of his era, poised and modest, kindly to the younger men who had not yet won their spurs, courteous to all men, yet solid in judgment and courageous in convictions, whoever might be the opponent in controversy. One cannot but feel that if the world were composed of such men the idea of war would be unthinkable. I can imagine these men growing heated in debate. I can imagine one of them calling down upon his opponent the wrath of the gods of logic to confound him, but I cannot imagine his doing this without inviting him to dinner afterwards or without feeling sad if some misfortune should befall his adversary or some unhappiness attend him. And so one, characteristic of the spirit of all that is best in American physics, has passed from us in the flesh, but his nature was such as to engender the thought that the love of his colleagues stretches to his new domain and that somehow or other, sensitive to all things beautiful, he is aware of it.

W. F. G. SWANN.

## GLADWYN KINGSLEY NOBLE

(1894-1940)

Gladwyn Kingsley Noble was born in Yonkers, New York, September 20, 1894, and died at his home in Englewood, New Jersey, December 9, 1940. His father was Gilbert Clifford Noble of Westfield, Massachusetts; his mother was Elizabeth Adams of New York City. He prepared for college at the Yonkers High School and took his A.B. and A.M. at Harvard University in 1916 and 1918. While at Harvard he attended the Officers' Training School, having enlisted April 11, 1918. After he received his commission as Ensign he was appointed Junior Officer in the Office of the Chief of Naval Operations. Most of his service was spent in Washington, working with codes. After the war he entered Columbia University for further work in biology and gained his doctorate in 1922.

From his first post in the American Museum of Natural History as assistant curator of the department of herpetology, he became successively associate curator and curator; in 1928 a new department of experimental biology was formed for him and from that time to his death he directed the two departments. In 1921 he was married to Miss Ruth Crosby of Hartford, Connecticut, and is survived by her and their two sons.

His field work, beginning in 1914, included studies in Guadeloupe and other localities in the West Indies, Newfoundland, Peru and Florida.

These few dated periods of his relatively short life give no indication of the activity of the two and a half decades of his maturity, which resulted in many significant contributions to several branches of biology. It was at the beginning of this period that I first knew him. During his postgraduate work at Columbia University I was his faculty adviser; he took courses on the anatomy and evolution of recent and fossil vertebrates and prepared his thesis under my official direction, although it was his own wholly original work. From that time I watched his never-faltering advance with sincere admiration and in close friendship.

His first scientific paper was published while he was an undergraduate. At that time he was evidently intent upon the classic problems of subspecific, specific and generic differences, geographic distribution, migration, faunal analysis and the like. Meanwhile his interest in herpetology was becoming dominant and the later

papers of the period dealt with reptiles as well as birds. In a number of such papers Noble was the junior author with Thomas Barbour, who evidently succeeded in inspiring his pupil with an abiding interest in field studies, in thorough and sound taxonomic work, in the living creature and its individual and racial history.

In a previous generation the great naturalist E. D. Cope had distinguished and described the rich North American fauna of salamanders, newts, sirens, tree-frogs, pond-frogs, toads and other Amphibia. But Cope's system dealt only with general features of the skeleton and surface of the animal. In 1917, in Noble's first paper in the *American Museum Bulletin*, we find him figuring the microscopic anatomy of the egg-membranes, gills and vascular tissue taken from a tree-toad that carries its eggs upon its back. Indeed histology with all its complicated techniques was always one of the main angles from which Noble attacked his major problems.

The first outstanding work that Noble produced was "The Phylogeny of the Salientia," published in the *American Museum Bulletin* in 1922 and dealing with the classification and phylogeny of the group that includes the frogs and toads. After long study Noble adopted the system proposed by G. C. Nichols, in which the articulations of the vertebrae serve as a basis of classification. He made an original and extensive examination of the arrangement of the thigh muscles and the distal tendons of the thigh in many types of frogs and drew up a revised classification illustrating the parallel modifications in the different suborders. From the vantage ground thus gained he went on to review the batrachian faunas of the different continents, tracing their spread from a northern origin. The fortunate discovery of a fossil spadefoot toad by Dr. Roy C. Andrews' expedition to Mongolia gave Noble a much desired clue to the evolution of the primitive family Pelobatidae and contributed to his views on the evolution and dispersal of the frogs of the different continents.

In the course of his herpetological work Noble developed an interest in the technique of clearing total specimens after the Schultz method. Later he greatly improved Hochstetter's method of staining and infiltrating entire specimens with paraffin, so that eventually he and his laboratory assistants turned out very lifelike frogs, toads, salamanders, small snakes and lizards, preserved entire and in natural postures. These were used in his Museum exhibition hall of living amphibians and reptiles, which was opened in 1927.

Another series of studies had to do with the modification of the heart, lungs and skin of those aquatic amphibians which absorb oxygen through their skins. Still another series showed that the characters of larval amphibians were of value in classification as indicators of relationship. This general topic was summed up in his 1925 address before the British Association for the Advancement of Science, entitled "The relation of life history to phylogeny within the Amphibia."

Other investigators had begun to study the effect of thyroid extracts on the metamorphosis of salamanders and Noble soon saw great possibilities in this direction as bearing on his field of investigation. During the course of his experimental work he therefore attended advanced lecture courses on endocrinology in several universities. His first published result was a report on "The production of cloacal glands in the adult female *Desmognathus fuscus* by testicular transplants; the change of tooth form in the adult male by castration." This was followed (1929) by "A metamorphic change produced in *Cryptobranchus* by thyroid solutions," and later (1930) by "The induction of egg-laying in the salamander, *Eurycea bislineata*, by pituitary transplants" by Noble and Richards, also by "Metamorphic change produced in *Siren* by thyroxin injections."

Among his numerous papers on the breeding habits of salamanders are: "Hedonic glands of the plethodontid salamanders and their relation to sex hormones," "The relation of the thyroid and pituitary to the molting process of the lizard *Hemidaetylus brookii*," by Noble and Bradley, and many others.

The strange ways of courtship and mating among fishes, frogs, lizards, snakes, birds, rats, guinea pigs and monkeys, used to be recorded separately by many specialists: ichthyologists, herpetologists, ornithologists, mammalogists, primatologists, and comparative psychologists, all writing in as many different technical journals which were rarely seen by anyone outside their respective specialties. Perhaps more than any other man Noble was rapidly integrating these fragments into a continuous and understandable picture. But though this changing picture of vertebrate courtship and mating was already discernible in part, Noble was never in danger of confusing the part with the whole. Because hormones from the endocrine glands were, at least in some cases, the activating agents, he did not fail to search for other leading factors in the always com-

plex results. As vertebrate animals were endowed with highly organized central nervous systems, it was next in order to study the reactions between the activating hormonal substances and the responding nervous controls. The complexity of a subject and the elaborate terminology and technique never intimidated him. He found time to attend more courses in neurology and did not easily lose himself even in that incomparable labyrinth which is the human brain.

What parts of the nervous system are prerequisite for the bubble-making phase in the nest-building of certain aquarium fishes? First, one must incite the fish to bubble-making, then extirpate a single spot in the brain which may be supposed to be involved in the nervous pattern for bubble-making. The application of the guess-try-guess-again method probably has to be made on many spots and many subjects; for successful results the fish has to recover and be subjected to another experiment; if a definite answer is given, the fish must be killed, stained, embedded, sectioned, and the brain sections must be compared with those from the uninjured, untreated controls.

Earlier investigations by others into animal behavior, resulting in the discovery of the "pecking order" among hens, were extended by Noble to fishes and other classes of animals, where he found similar rules in observance. These studies in social dominance are illustrated by one of the exhibits in his Hall of Animal Behavior.

Noble consistently maintained that the proper scope of museum exhibition was not only to present faithful pictures of things as they are but to show as far as possible the underlying principles and to stimulate the quest for further knowledge. That tadpoles turn into frogs is a biological miracle which has lost its element of wonder to immature minds. But what makes a tadpole turn into a frog? And, for that matter, why are there normally two kinds of adults, one male, the other female? Noble did not offer his Museum public the dry husks of sweeping generalities. Nor, on the other hand, was he ready at first to give well tested answers to such questions. So he wisely went on studying and experimenting along many lines, meanwhile turning out an astonishing series of taxonomic reports on collections of amphibians and reptiles and field observations on the breeding habits of many individuals of both classes. His textbook, *The Biology of the Amphibia*, is a mine of carefully digested knowledge in a very wide field. Between 1913

and 1940 he published 178 papers and monographs. He was elected a member of the American Philosophical Society in 1933.

From 1926 until his death Noble was eminently successful in planning and running all these rapidly expanding projects. In the American Museum of Natural History the department of herpetology, which he did much to build up, includes more than 110,000 catalogued specimens. His Hall of Reptiles, although falling far short of his own ideals, abounds in arresting and informative exhibits, while his Hall of Animal Behavior is successful in translating many technical results into exhibits of unmistakable clarity and human significance. The department of experimental biology, which crowds the two upper floors of the African Wing of the Museum, is the crowning achievement of his life. The continuing work of his colleagues and students perpetuates his ideals and his hopes and constitutes his living memorial.

WILLIAM K. GREGORY.

### WILLIAM ALBERT NOYES<sup>1</sup>

(1857-1941)

William Albert Noyes departed this life on October 24, 1941, at his home in Urbana, Illinois, aged eighty-three years, eleven months.

How familiar the form of such an announcement! It marks the beginning and ending of life, the two covers of the book, but of the contents—particularly rich in this case—not a word.

Dr. Noyes was born in the country near Independence, Iowa, November 6, 1857. His family, of New England Congregational stock, lived under pioneer conditions not favorable to the study of chemistry and physics; nevertheless, as a boy he managed to get hold of some scientific books and became interested in these subjects at an early age. In the midst of farm work he prepared himself for college, almost without a teacher. In the Iowa college of that day little chemistry was taught, but this was supplemented by a large amount of self-instruction. At the end of four years the young man was W. A. Noyes, A.B. and B.S., in spite of the fact that he had taught school every winter to pay expenses. He conducted much of his graduate work himself while carrying a

<sup>1</sup> Reprinted from *Science*, November 21, 1941, Vol. 94, No. 2447, pages 477-479.

full load of teaching, so that he was able to take his doctor's degree in chemistry at Johns Hopkins under Remsen in a year and a half, before reaching the age of twenty-five.

Such unremitting labor was characteristic of Dr. Noyes throughout his long life. During a year as Instructor at the University of Minnesota he performed much analytical work for the State Geological Survey (just as he later did in Indiana) and began original research of his own. The research was continued at the University of Tennessee, where he was professor from 1883 to 1886. A seventeen-year period followed at Rose Polytechnic Institute, a small school of high grade. This was just the sort of place where many a man, condemned to a heavy teaching load, with improvised equipment and with little or no graduate assistance, would have sunk out of sight; Dr. Noyes attracted the attention of the chemical world by his researches and his books.

From Rose he stepped in 1903 to the position of Chief Chemist of the Bureau of Standards (the first to hold that title), and from there to Head of the Department of Chemistry of the University of Illinois, where he served with distinction from 1907 to 1926, becoming then Professor Emeritus. In recognition of his success in building during this period a great department, the University in 1939 dedicated the scene of his labors as the William Albert Noyes Laboratory of Chemistry. Dr. Noyes himself took part in the dedication, surrounded by many staff members whom he had selected. His pathway had been strewn with well-deserved honors: presidency of the Indiana Academy of Science (1894), vice-presidency of the American Association for the Advancement of Science (1896), presidency of the American Chemical Society (1920); degrees from Clark in 1909, Pittsburgh in 1920, and Grinnell (his alma mater) in 1929; memberships in the American Academy of Arts and Sciences, the National Academy of Sciences, the American Philosophical Society (elected in 1914); the Nichols medal (1908), the Willard Gibbs medal (1920), the Priestley medal (1935).

Dr. Noyes was married three times. By the first union he leaves W. Albert Noyes, Junior, Head of the Chemistry Department of the University of Rochester; by the second, Charles Edmund, engaged in newspaper and information work in Washington, D. C.; by the third, his widow Katharine Macy Noyes and their sons, Richard Macy, graduate student in chemistry at Cali-

fornia Institute of Technology, and Henry Pierre, Harvard undergraduate.

It is difficult in so short a biography to give a true idea of Dr. Noyes' many-sided life work. Perhaps we should first characterize his research, the principal part of which was performed with his own hands. From the oxidation of benzene derivatives with potassium ferricyanide, which links him with his teacher Remsen, he turned to the exact determination of the hydrogen-oxygen ratio, which is at the basis of our system of atomic weights. So excellent was this piece of work that it stands today as one of the nearest approaches to the probable truth for this value. His later determination of the atomic weight of chlorine was also outstanding. Methods for the determination of phosphorus, sulfur and manganese in iron constituted a fruitful excursion into the analytical field. During the course of a long series of important researches on camphor Dr. Noyes was the first to furnish definite proof of its present accepted structure (the Bredt formula). Other organic researches dealt with the hydrolysis of maltose and dextrin, molecular rearrangements, optically active diazo compounds and amine oxides. He was active as an investigator almost to the end of his life.

In 1901 a study of the formation of nitrogen trichloride from ammonia and chlorine led Dr. Noyes to the hypothesis that the molecules of elements may ionize into positive and negative parts and to the thought that two kinds of nitrogen trichloride might be capable of existence, one in which the nitrogen is positive and the chlorine negative, and one in which the opposite relations hold. He was thus one of the earliest investigators to recognize that the older conceptions of valence were inadequate to explain experimental facts. From that time on he took an active part in the development of the theory of valence and reactions.

At the turn of the century powerful influences began to operate under which the American Chemical Society, originally a local organization in New York, was destined to become the great national organization that it is to-day. Dr. Noyes was one of the leaders in this development. He saw that the greatest source of strength in such a society lay in disseminating the results of research. His friend Edward Hart had put the *Journal of the American Chemical Society* on its feet; Dr. Noyes took over the editorship in 1902 and held it for fifteen years. Together these



men made the *Journal* respected the world over and drew to it the best contributions of American chemists. Besides original articles there had been since 1897 an abstracts section limited to American chemical research. This was not broad enough to satisfy Dr. Noyes. In 1907 he founded *Chemical Abstracts*, summoning to his aid a brilliant corps of nearly thirty assistant editors, and remained its editor for three years at considerable personal sacrifice. Thus he created a "key to the world's chemical literature," as the greatly expanded periodical now justly calls itself. Through the joint efforts of Noyes, Parsons and many others the society grew by leaps and bounds. Dr. Noyes found time to serve as Secretary from 1903 to 1907 and as President in 1920. In the latter year he became editor of the series of American Chemical Society Scientific *Monographs*, a position which he held to his death; he was also the first editor of *Chemical Reviews*, from 1924 to 1926.

As if this varied editorial output were not enough, several successful text-books bear the name of Noyes: *Elements of Qualitative Analysis*, *Organic Chemistry for the Laboratory*, *Organic Chemistry* (with a German translation), *Textbook of Chemistry*, *Laboratory Exercises in Chemistry*, *College Textbook of Chemistry*. *Modern Alchemy*, a book for lay readers, in collaboration with W. Albert Noyes, Jr., was published in 1932. One need not wonder that Dr. Noyes was often seen at meetings, on the train or at home, with a sheaf of printer's proofs in his hand.

The personal character of William Albert Noyes has been left to the last, but it is the key to all that has preceded. One would judge from his life that genius is fine intellect with capacity for a tremendous amount of hard work. He was first of all a scientific thinker, less affected by emotion or selfish bias than any man the writer has ever known, and utterly unassuming. He was a hard, persistent fighter for whatever he thought was right, and he was right most of the time. Unusual patience, earnestness and the force of example contributed to his success as a teacher. The fabric of Dr. Noyes' achievements was shot through with loyal friendships and strong humanitarian sympathies. Perhaps his deepest interest was religion—a liberal faith which he felt to be in harmony with scientific truth and at the same time a vital faith, something to be lived.

Dr. Noyes was a strong believer in promoting better international understandings as a means of preserving peace and curb-

ing aggression. He felt that scientists, on account of their international community of interest, have a special duty in this field. During the troubled years which have followed the first World War, he made vigorous efforts to draw scientists of different nations closer together. He attended meetings in Europe on different occasions, and published two pamphlets entitled "Building for Peace," besides other articles. His belief never wavered that such efforts, by himself and others of like mind, will finally prevail. Certainly the life and work of William Albert Noyes, distinguished scientist who loved his fellow men, will be no small influence toward the better world of which he dreamed.

AUSTIN M. PATTERSON.

### JOSIAH HARMAR PENNIMAN

(1868-1941)

Josiah Harmar Penniman was born on July 20, 1868, at Concord, Massachusetts, the son of James Lanman and Maria Davis (Hosmer) Penniman, the family descending from James Penniman, who arrived in New England on the ship "Lion" in 1631. Penniman came to Philadelphia as a boy and prepared for college at the William Penn Charter School. In 1886 he entered the University of Pennsylvania, obtaining the A.B. degree in 1890, the Ph.D. in 1895, the LL.D. in 1922 and the D.C.L. in 1939. He became an instructor in English the year he graduated from the College and in 1896 he was appointed Professor of English Literature. In this position he continued until his retirement despite his heavy administrative duties first as Dean and then as Provost of the University.

In 1897 he became Dean of the College of the University of Pennsylvania occupying that post for twelve years until he resigned in order to devote himself to study and writing. Two years later, however, he was elected Vice Provost under Provost Edgar Fahs Smith, whom he succeeded in the provostship in 1920 as acting Provost in charge of the educational activities of the University. In 1923 he was made Provost-President, a dual office which he filled till its division in 1930, when President Thomas Sovereign Gates took over the duties of the President, Dr. Penniman continuing in charge of educational policies as Provost till his retirement in 1939.

A versatile scholar with broad cultural interests, he was an inspiring teacher, a gifted speaker and an able executive. He attained distinction as an author and literary critic and was well known as a collector of rare books and manuscripts. As head of the University he was always keenly alive to the obligations and opportunities of higher institutions of learning in the promotion and dissemination of knowledge and culture, and in the preparation of students for active and intelligent citizenship. A bachelor during most of his life he married Mrs. Ida Jutte Walther in 1929, and the Provost's House on Pine Street became a center of gracious hospitality and entertainment.

His first scholarly work was in the field of the English drama in the period of Ben Jonson, in which field he published a well known volume on *The War of the Theatres* in 1897. From this line of interest he turned to literary criticism, devoting himself more especially to the novel and the English Bible. His volume on *Books About the English Bible*, published in 1919, is a scholarly though semi-popular volume attesting his painstaking study and understanding of this special field. He edited Ben Jonson's *Poetaster* and Thomas Dekker's *Satiromastix* in Belles Lettres Series in 1905. He wrote numerous articles on literary topics and on education, his long practical experience both as a teacher and as an administrator making him an authority in the latter field in which his views on the place and rôle of the humanities and cultural history in the educational programs of the day carried much weight.

Always interested in authors and books he collected many rare volumes on English literature, and, with his brother James Hosmer Penniman, assembled a large and highly specialized library of over 20,000 volumes on education and pedagogy. These were presented by the latter to the School of Education of the University of Pennsylvania as a foundation for a special library—the Maria Hosmer Penniman Memorial Library of Education in honor of his mother.

A gentleman and a scholar, Provost Penniman's genial personality and lively interest in his colleagues contributed much to stimulate research and writing by others especially among younger scholars. Toward this end he was instrumental during his provostship in establishing a faculty research fund in the administration of which he was keenly interested during his later years.

He was a trustee of the University and of the Evans Dental Institute, Lt. Colonel of the United States Army (reserve), Chevalier de la Légion d'Honneur; Fellow of the American Association for the Advancement of Science, the New York Genealogical and Biographical Society; member of the American Philosophical Society (elected in 1901), English Dialect Society, Modern Language Association of America, English Association of Great Britain, Society of Colonial Wars.

His quiet passing on April 10, 1941, from a heart attack, marked the end not only of a useful and influential career, but also of "a happy life," because, as he himself said, "I have done the things I like best to do."

WILLIAM E. LINGELBACH.

### ALFRED STENGEL

(1868-1939)

Dr. Alfred Stengel was born in Pittsburgh, Pennsylvania, on November 3, 1868. His father, a civil engineer, had come to this country about 1850 from Germany. Alfred Stengel, when not quite eighteen years of age, came to Philadelphia and entered the School of Medicine of the University of Pennsylvania. He graduated third in his class in 1889 and remained for the rest of his life in Philadelphia. In 1892, he became the office assistant of Dr. William Pepper, then Professor of Medicine and Provost of the University. In 1895, he was appointed Assistant Director of the William Pepper Laboratory of Clinical Medicine, later becoming Director. He began his teaching career in 1893 and in 1897 was made Professor of Clinical Medicine and, in 1911, Professor of Medicine. On his retirement in 1937, he was elected Emeritus Professor of Medicine.

Dr. Stengel at various times served on the Staff of the Philadelphia General, Howard, Children's, Pennsylvania and University Hospitals.

He was a prolific writer and his bibliography is an extensive one. He wrote the section on *Diseases of the Blood* in the *Twentieth Century Practice*, on "Diseases of the Intestines" in Osler's *Modern Medicine*, and (with Dr. Richard A. Kern) on "Diseases of the Liver and Bile Passages" in Nelson's *Loose-Leaf System of Medicine*. His one book was his very successful *Text Book of Pathology*, the first edition of which was published in 1898. Eight

editions have since appeared; and in the fifth edition Dr. Herbert Fox collaborated as joint author.

In addition to his teaching, hospital work and the demands of a large office and consulting practice, Dr. Stengel rendered the University of Pennsylvania splendid service as an administrator.

In 1928 he was elected a Term Trustee to serve for ten years and in 1931, with the change in the administrative system at the University, he was made Vice-President in Charge of Medical Affairs. In this position he had under his care the School of Medicine, the Graduate School of Medicine, the Dental and Veterinary Schools and all other medical affairs of the University.

He was a Manager of the University, Graduate, Orthopaedic, and Veterinary Hospitals, a Manager of the Wistar Institute and later President of its Board. He was a member of the University Committee of the Henry Phipps Institute. To these, and many other University duties, he gave his time and unselfish service.

The need at the University Hospital for a building or wing to house various clinics, laboratories, outpatient departments, etc., was early recognized by him. The Martin Maloney Memorial Clinic stands today as a monument to Dr. Stengel's foresight and planning. He persuaded Mr. Maloney to contribute the money needed for its erection. It was opened in 1929. In the impressive lobby of the Maloney Clinic hangs the excellent portrait of Dr. Stengel by Johansen.

Dr. Stengel was a member of the Association of American Physicians, The American Pediatric Society, the American College of Physicians, of which he was President, and he was a Fellow of the College of Physicians of Philadelphia, which he served as President from 1934 to 1937. He was elected a member of the American Philosophical Society in 1903.

He was the recipient of honorary degrees from the Universities of Pittsburgh, Lafayette and Pennsylvania. He was a Major in the Medical Reserve Corps of the United States Army.

Busily engaged, chiefly with his administrative duties, and in apparently perfect health, Dr. Stengel died suddenly on April 10, 1939, he then being seventy and one-half years of age. The University of Pennsylvania lost a very valuable servant, Philadelphia a civic minded citizen, and a host of former students, patients, colleagues and acquaintances a well beloved and admired friend.

WILLIAM PEPPER.

## LEWIS B. STILLWELL

(1863-1941)

Lewis B. Stillwell was born in 1863, near Scranton, Pennsylvania, and he enjoyed the usual high school preparation for college. Pursuing his college course for two years at Wesleyan University in Middletown, Conn., he transferred to Lehigh University for the study of electrical engineering, completing that course in 1885. This study led him directly to the laboratory of the Westinghouse Electric Company (then a young and small company which later became the Westinghouse Electric and Manufacturing Company), and there he was made first assistant to the gifted Chief Electrician of that Company. In this position it was Stillwell's fortune to hold an active part in the development of the alternating-current system for power which was then being pushed forward under the pioneering leadership of Mr. George Westinghouse. With the influx of some other notable young men Pittsburgh became an additional center of progress for the applications of electricity, such as were already growing up in other parts of the country.

Thus Stillwell grew in electrical engineering stature and in 1890 became Chief Electrical Engineer of the Company. He came to be particularly concerned with the responsibility for the development of what he denominated "system engineering." This included the many problems then presenting themselves in the new field of central-station practice and the transmission and distribution of electricity by alternating-current circuits.

Stillwell fought the battle of the electrical industry in the financially discouraging but scientifically romantic decade of the '80's and well into the '90's—at which time the industry suffered in high degree "the rhythmical anguish of growth." At that date chemistry and physics could contribute relatively little enlightenment, money was scarce, and progress depended on intuition and resourceful experiment carried on with little fundamental guidance.

Edison, Thomson, Bell, Weston, Sprague, Brush, Westinghouse, Stanley and their peers were leaders in America. Stillwell did his part and was soon making inventions relating to feeder regulation and other features of electrical-power systems. Later his inventions extended to the transformer type of feeder regulator, the time-limit circuit breaker, and the diagrammatic pilot-controlled

switchboards which are of such general utility in remote-control operations. It requires a certain stamp of heroism to carry on the work of the day resourcefully in pioneer times and to produce improvements.

It was long ago said that success builds a man and also ruins him. The early creators in the electrical industry have dwelt in the dazzling splendors of Olympus. They also have endured the despairs of Hades. It is the latter that tries the courage, the former that tests the tenacity of a man; and these men that I have named, with others, came through the blazing trail with stiffened fiber and the gratitude of their fellow men.

During this early part of his career Stillwell became acquainted with Edward D. Adams and Coleman Sellers (Vice-president of the American Philosophical Society, 1898-1902) who were then the President and the Consulting Engineer of the unique, great, projected Niagara Falls Power enterprise. This led to active consideration of the adaptability to the needs of the Niagara Falls Power project of the yet unseasoned idea of polyphase alternating currents in power transmission; and it further led in 1897 to Mr. Stillwell's retiring from the Westinghouse Company and becoming Electrical Director of the Niagara Falls Power Company.

The conditions of development in the fast growing Westinghouse Company led to a comprehensive study by Stillwell and his associates of the fundamental questions of phases and frequencies for the alternating currents in power transmission; and in the late autumn of 1890, at Stillwell's suggestion, a frequency of 60 cycles per second was unanimously endorsed as a standard by the company's principal designers, and this remains our major frequency in America. As an alternative, and for use where a large part of the power had to be converted for utilization as direct current, a frequency of 30 cycles per second was recommended. For the Niagara Falls plant the speed of hydraulic turbines ultimately resulted in the use of 25 cycles per second instead of Stillwell's logically preferred 30 cycles per second for the then conditions of Niagara Falls.

Conditions were now moulded so that Stillwell's influence on practice of generating and transmitting power was enlarged to a pre-eminent place. It was indeed a happy circumstance and

(as Ring Lardner puts it) "luck smiles on the worthy." The circumstance was as happy for the art as it was for Stillwell. In the Niagara Falls position Stillwell directed the installation and operation of the epoch-making Niagara Falls electrical plant, and the problems encountered in this work were wisely solved. They also led to some important patented inventions.

In 1900 Stillwell retired from his Niagara Falls post and set up as an independent consulting engineer—a move which carried success with it, for he became at once Electrical Director of the New York Subway Construction Company, and in 1905 Consulting Engineer of the Hudson and Manhattan Company. I became intimately acquainted with him five years later. He proved to be always friendly in advice and possessing an imagination which enabled him to view all sides of a question as well as to foresee the bearing of any solution on the prejudices of others. His advice was sound and fertile. His knowledge and experience were wide and serviceable. The qualities of optimism and pessimism have been often discussed, with optimism extolled and pessimism deplored; but such discussions arise from a narrow and incomplete conception. The sound and socially fruitful human being needs a combination of the two qualities, and this combination Stillwell possessed in full degree.

Stillwell also possessed another quality which I admired and which increased his influence as an engineer. This was his ability to emancipate himself from the cramping cloak of an external "authority" and yet retain at a high level his spirit of cooperation. This is a manifestation of farsighted generosity and also of discipline of the mind.

Stillwell had a deep interest in the development of the most fruitful mode of education for men who should become of foremost quality as engineers, as a feature in the improvement of the profession. If the result of education may be defined, as has been suggested, as the state of knowing what to do under any given set of circumstances, and how and when and where to do it, then Stillwell again met a test—this time of a delightfully educated man.

Stillwell's career as a consulting engineer was an active and distinguished one. A large part of it related to the development of elevated, subway, tunnel and steam-railroad train electrifica-



tion; another part of it related to steam-electric and hydroelectric power plants; still other parts to varied fields; and all of it was worthy of the man. The live office of a consulting engineer in growing industry such as the electrical industries during Stillwell's life is likely to contain various men of resourceful originality, but the senior figure of the office nevertheless is likely to be the central influence for stimulating that originality to creative effectiveness. Stillwell was responsible for plans when electrification was broadly adopted for the elevated railways in New York City and later for the subways. Many devices were introduced into these plans, such as the umbrella type of protection for the third rail that he had previously used on the Wilkesbarre and Hazelton Railway, that are details of design but nevertheless were then achievements of importance, as is shown by their general adoption as standards thereafter. Another example of Stillwell's originality is the Hauto Plant of the Lehigh Coal and Navigation Company, which had a wide-flung reputation in its early days as the first large electric power-generating plant in America deliberately located "at the mouth of the mine." These illustrations serve to show the broad and original character of Stillwell's engineering accomplishments.

Mr. Stillwell's honors and responsibilities included membership in the National Academy of Sciences, the American Philosophical Society (elected in 1898), and the most important of our engineering societies. He was a past president of the American Institute of Electrical Engineers and of the American Institute of Consulting Engineers, and he was a past chairman of the Engineering Foundation. The American Institute of Electrical Engineers conferred on him its great Edison Medal for achievement in electrical engineering and its Lamme Medal for achievement in development of electrical apparatus. He was active in many important matters within the engineering industry, and he received the Doctor of Science degree from Wesleyan University and Lehigh University and in 1920 he became a Life Trustee of Princeton University. He also received medals in recognition of his Niagara Falls work and his work of encouraging and consolidating the research supported by the Engineering Foundation and the national engineering societies. His contributions to human society were not solely through the engineering profession, but extended over a wide field of influence, and for twenty-two

years included active interest as a life trustee in the affairs of Princeton University. He was an interested traveler and observer in foreign countries and a friend of his fellow men.

DUGALD C. JACKSON.

### DAVID HILT TENNENT

(1873-1941)

David Hilt Tennent, son of Thomas and Mary (Hilt) Tennent, was born on May 28, 1873, in Janesville, Wisconsin. After graduation from Olivet College, Michigan, in 1900, he began his professional training as a zoologist at Johns Hopkins University, where he received the Ph.D. degree in 1904. During the year 1903 he served as acting Professor of Biology and Physics at Randolph-Macon College. In 1904 he became Lecturer in Biology at Bryn Mawr College, and for the remainder of his life he was associated with that institution, where he was made Professor in 1912 and Research Professor in 1938.

Before the completion of his university training his biological interests had taken him to the Marine Biological Laboratory at Woods Hole, Massachusetts, where from 1902 to 1905 he took part in the instruction of the class in invertebrate zoology. Later, from 1920 to 1922 he was in charge of the course in embryology. His connections with the Marine Biological Laboratory, of which he was for many years a trustee, continued up to the time of his death; but in the later part of his scientific career his interest in the echinoderms, which he found peculiarly well suited to his experimental studies, carried him to many laboratories in different parts of the world where new forms could be obtained. Among the various places where his scientific work was done were Jamaica, Naples, Australia, and Japan. In the latter country he was Visiting Professor at Keio University, Tokyo, during the year 1930-31; and his last paper, published posthumously in 1941 as a joint contribution of himself and T. Ito, was one of the products of this very stimulating year.

His most important scientific work is closely associated with the Dry Tortugas Laboratory of the Carnegie Institution of Washington. Not only did he find the echinoderm fauna of that locality particularly rich, but he liked the informal atmosphere of the small and relatively isolated laboratory where work could

be carried on in company with a few congenial associates with a complete freedom from outside distractions. Parts of many summers were spent at this laboratory, of which, during the last three years of his life, he was Executive Officer. In that position he had special opportunities to give help and encouragement to a group of younger biologists who remember with gratitude his stimulating suggestions and his friendly interest in their scientific and personal problems.

The list of his scientific publications is not as long as it might have been had he set for himself less exacting standards of thoroughness in all the details of his experiments and of care in the presentation of his results. His work was never superficial nor his conclusions hastily reached. Though he was an experimentalist rather than a systematist, virtually all his work was confined to the single group of the echinoderms. What he lost by thus limiting the breadth of his field he perhaps more than gained by increasing its depth. To an extent that is too rare among experimental biologists he appreciated the advantages of working with a type of material that is known to its investigator from a great many different points of view.

Within these self-imposed limits his work covered a rather wide range of subjects. His first interest was in embryological problems of early development and fertilization, including the behavior of the chromosomes in fertilization. His most extensive work, which covered a period of many years, had to do with cytological and embryological problems associated with hybridization. With great patience he developed methods for the successful cross fertilization of different species of echinoderms belonging to nearly-related and distantly-related groups, and then carefully analyzed the respective shares in the resulting hybrids of the paternal and maternal germ cells, as well as those of the nuclear and cytoplasmic portions of the egg cell. In collaboration with associates at Bryn Mawr College and at the Tortugas Laboratory he made extensive studies of the organization—in particular the chemical organization—of the echinoderm egg. Among other lines of attack of this problem was a comparison of the staining reactions of the unaltered egg with those of its various chemical constituents after their isolation. Several years before his death he became interested in the problem of photosensitization as applied to the germ cells. Of all the studies he had undertaken he found this

the most interesting; but unfortunately death interrupted his work in this field while it was still in progress.

Though modest and retiring in disposition, his professional attainments and personal qualities were highly valued by his colleagues, who honored him with the presidency of the American Society of Zoologists in 1916 and of the American Society of Naturalists in 1937. The scientific importance of his work received recognition by his election to the National Academy of Sciences in 1929 and to the American Philosophical Society in 1938. He was a member of both Phi Beta Kappa and Sigma Xi.

To those who knew him, his most prominent characteristic was his faithfulness to his exceptionally high standards of personal and scientific conduct. Few men have possessed a stronger sense of obligation to do what they considered just and right. Though reserved with strangers, he had a keen sense of humor, and was a delightful companion to those who knew him well, as all can testify who shared with him the carefree scientific life at the Tortugas Laboratory. The loyalty of his students was exceptional even in the case of a professor of his high standing as a scientist and a teacher.

His untimely death occurred at Bryn Mawr on January 15, 1941. Surviving him are his wife Esther Margaret Maddux Tennent, whom he married in 1909, and a son, David Maddux Tennent.

M. H. JACOBS.

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